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November 9, 2010

MEMORANDUM FOR: F/PR - James H. Lecky

FROM: F/NWC3 - John W. Ferguson

SUBJECT: Estimation of Percentages for Listed Pacific Salmon and Steelhead Smolts Arriving at Various Locations in the Columbia River Basin in 2010

Each year your office requests a description of how the Fish Ecology Division calculates the percentages of listed wild and hatchery fish arriving at selected Columbia and Snake River projects. These estimates are necessary for evaluating the potential impacts of proposed research on listed species. Given new hatchery release estimates, we have computed percentages for 2010. The attached tables show our best estimates for the total numbers of protected juvenile Pacific salmon and steelhead arriving at Columbia River and Snake River dams during the 2010 outmigration, and the percentage of the total collection they will comprise at each dam. We have developed estimates based on transportation with spill river conditions that have existed in the past and on a full transportation scenario (with no spill). Tables 1-6 show the development of the estimates, Tables 7-10 summarize the estimates for each listed species at each project, and Table 11 presents our estimates of the total run size for each listed group of fish.

Several Snake River species will have unmarked hatchery fish released for the 2010 outmigration. Because we have encountered unmarked hatchery spring/summer Chinook salmon in the past, we have adopted a practice of labeling any unclipped spring/summer Chinook salmon that is greater than 124-mm in fork length as hatchery-origin fish. To derive this fork length, we analyzed data from wild spring/summer Chinook salmon PIT-tagged in their natal streams (from our wild parr marking project; Permit #1406, Study 1) that were subsequently captured and re-measured at one of the lower Snake River dams during slide-gate evaluations (1989-1994 and 1999-2004).

For several groups of fish, we could find no new information; therefore, our estimates for these groups are the same as last year.

Please discuss and distribute this memorandum with all interested parties.

Attachments

cc: F/NWC1 - Ford
F/NWC2 - Dickhoff
F/NWC3 - Casillas
F/NWC3 - Dey
F/NWC3 - Williams
F/NWR1 - Turner
F/NWR3 - Griffin
F/NWR3 - Rule
F/NWR4 - Tehan
F/NWR5 - Suzumoto

# YEARLING CHINOOK SALMON ESTIMATES

**Snake River ESU**

The estimate of wild spring/summer Chinook salmon arriving at Lower Granite Dam is based on Idaho Department of Fish and Game and Oregon Department of Fish and Wildlife redd counts for brood year 2008. Redd counts were grouped by drainages where fecundity rates were available: (Middle Fork of the Salmon River, South Fork of the Salmon River, Salmon River (excluding Middle and South Forks), Clearwater River, Imnaha River, and Grande Ronde River). The egg-to-smolt survival rate (to Lower Granite Dam) was set at 10%. We estimate that 1,558,109 wild/natural spring/summer Chinook salmon will reach Lower Granite Dam in 2010.

Under the 2005 listing guidelines, hatchery fish must now be tracked, not only by their listing status, but also by whether they have been adipose-fin clipped. We estimate that 14,793,186 hatchery spring/summer Chinook salmon smolts will be released from Idaho (13,503,786) and Oregon (1,289,400). Of these 14,793,186 hatchery spring/summer Chinook salmon smolts, 5,993,536 will be listed (5,238,900 with AD-clips and 754,636 without AD-clips) and 8,799,650 will be unlisted (7,473,250 with AD-clips and 1,326,400 without AD-clips).

In order to estimate how many hatchery smolts will reach Lower Granite Dam, we first estimated the percentage composition of Snake River spring/summer Chinook salmon arriving at the dam from listed hatcheries (Table 1). Using the mean survival estimates for the 1996-2009 outmigrations (excluding 2001, which was a record low flow year), we estimated the total number of hatchery fish that will arrive at Lower Granite Dam. The mean survival estimate for each hatchery from these Memo year years was applied to the 2010 projected release numbers for each hatchery. We estimate that 8,968,158 or 60.62357% of the 14,793,186 hatchery fish released will arrive at Lower Granite Dam. Of these 8,968,158 hatchery spring/summer Chinook salmon smolts, 3,113,152 will be listed (2,694,201 with AD-clips and 418,951 without AD-clips) and 5,855,006 will be unlisted (5,032,638 with AD-clips and 822,368 without AD-clips).

In June 2005, Snake River hatchery fall Chinook salmon were listed under the ESA. While most hatchery fall Chinook salmon are released as subyearlings, the Nez Perce Tribe and Washington Department of Fish and Wildlife release yearling fall Chinook salmon above Lower Granite Dam. Because these fish may not be distinguishable from yearling spring/summer Chinook salmon, they have been included in the yearling estimates detailed below.

Holdover fall Chinook salmon (wild fish that do not outmigrate as subyearlings and hatchery fish released as subyearlings that did not outmigrate as subyearlings) show extreme year-to-year variability in the numbers collected at the various dams. Also, based on PIT-tag detections of holdover fall Chinook salmon, it is known that these fish can stop migrating anywhere along their migration route and holdover to the next spring. These two characteristics of fall Chinook life history make it extremely difficult to estimate how many holdover fish will outmigrate in any given year. Therefore, no estimates of holdover yearling fall Chinook salmon are included.

In 2010, 206,000 AD-clipped and 259,000 Non-AD-clipped yearling listed hatchery fall Chinook salmon will be released above Lower Granite Dam. Using an average survival rate of 0.890, we estimate that 413,850 (183,340 AD-clipped and 230,510 Non-AD-clipped) yearling listed hatchery fall Chinook salmon will arrive at Lower Granite Dam.

Knowing the total number of hatchery fish, the number of listed hatchery fish, and the number of wild fish arriving at Lower Granite Dam, we estimated the percentage composition of listed hatchery fish and wild fish arriving at the dam as follows:

total yearling smolts = total hatchery fish + wild fish =
10,940,117 = (8,968,158 + 413,850) + 1,558,109

% wild fish to dam = wild fish/total smolts =
14.24216% = 1,558,109/10,940,117

% listed hatchery fish = listed hatchery fish/total smolts =

| | |
|---|---|
| AD-clip spring/summer | 24.6268% = 2,694,201/10,940,117 |
| Non-AD-clip spring/summer | 3.82949% = 418,951/10,940,117 |
| AD-clip yearling fall | 1.67585% = 183,340/10,940,117 |
| Non-AD-clip yearling fall | 2.10702% = 230,510/10,940,117 |

We set fish guidance efficiencies (FGE) at Lower Granite and Little Goose Dams to 0.391 and 0.453, respectively. Using an FGE of 0.391, the total collection at Lower Granite Dam will be 4,277,586 (10,940,117 x 0.391), based on 10,940,117 smolts arriving at the dam. The collection at Lower Granite Dam will be comprised of the following:

| Listed groups | Total | Percent |
|---|---|---|
| Wild spring/summer | 609,221 | 14.3 |
| AD-clip hatchery spring/summer | 1,053,433 | 24.6 |
| Non-AD-clip hatchery spring/summer | 163,810 | 3.8 |
| AD-clip hatchery yearling fall | 71,686 | 1.7 |
| Non-AD-clip hatchery yearling fall | 90,130 | 2.1 |
| **Unlisted groups** | | |
| AD-clip hatchery spring/summer | 1,967,750 | 46.0 |
| Non-AD-clip hatchery spring/summer | 321,556 | 7.5 |

Tucannon River fish, both hatchery and wild, are within the Snake River spring/summer Chinook salmon Evolutionarily Significant Unit (ESU) and are considered listed fish. In spring 2010, 22,286 wild and 172,000 non-AD-clipped hatchery spring/summer Chinook salmon are expected to outmigrate from the Tucannon River. The Tucannon River joins the Snake River between Little Goose and Lower Monumental Dams. Because of the short distance from the confluence to Lower Monumental Dam, we assumed no mortality of these fish prior to Lower Monumental Dam. The estimates shown in Table 2 and Tables 7-8 reflect the addition of these fish above Lower Monumental Dam.

Since 1995, some of the PIT-tagged fish bypassed at the collection dams (Lower Granite, Little Goose, Lower Monumental, and McNary Dams) have been returned to the river to continue migrating inriver. This return of fish to the river requires adjustment of our estimates of the number of listed fish that reach McNary Dam. We estimated the number of fish that will be PIT-tagged for 2010 and, as described in Appendix A, adjusted for fish diverted to transportation at each Snake River collector dam. If transportation occurs at McNary Dam, we also assumed that 100% of all PIT-tagged fish would be returned to the river. A detailed description of how we estimated the impact of returning PIT-tagged fish to the river is presented in Appendix A. We estimated that 41,482 PIT-tagged spring/summer Chinook salmon from the Snake River (including 16,123 wild and 10,902 listed hatchery fish) will be collected at McNary Dam because they were returned to the river at an upstream dam(s). These numbers represent collected fish. Dividing the collected number by the FGE at McNary Dam (0.377), we determined that 42,767 wild (16,123/0.377) and 28,918 listed hatchery (10,902/0.377) fish will arrive at McNary Dam and must be added to the number of fish that were estimated to reach McNary Dam as a result of not having been collected at an upstream dam (column "Listed fish to McNary", Table 2).

**Upper Columbia River ESU**

The Upper Columbia River ESU spring Chinook salmon is listed as endangered under the ESA. The ESU begins at the confluence of the Yakima and Columbia rivers and continues upstream to Chief Joseph Dam.

Adults that returned in 2008 produced the smolts that will outmigrate in 2010. We obtained 2008 redd counts for the major Columbia River tributaries in this ESU from Washington Department of Fish and Wildlife (WDFW) and the Yakama Indian Nation. Fecundity estimates for this ESU range from 4,000 to 5,500 eggs per female. Estimates for egg-to-smolt survival generally range up to 19%. Using the median egg count, 4,750, and an egg-to-smolt survival estimate (to the first dam encountered) of 7.5%, we estimated the number of smolts that each stream will produce.

We also have hatchery release estimates for this ESU from WDFW and the U.S. Fish and Wildlife Service. There are no survival

estimates for these hatcheries. So, based on the distance from the hatchery to the first dam the fish will encounter, we assigned the same survival estimates for Snake River hatcheries, with similar distances to the first dam. Using this method, we assigned a survival rate of 0.778 (Dworshak Hatchery's survival estimate to Lower Granite Dam) to the fish from Winthrop, Methow, Entiat, and Leavenworth Hatcheries, a survival estimate of 0.686 (Rapid River Hatchery's estimate to Lower Granite Dam) to Cle Elum Hatchery, and a survival estimate of 100% to Eastbank and Ringold Hatcheries.

We used per-project survival estimates for spring Chinook salmon in the Columbia River above McNary Dam as summarized in the Mainstem Columbia River Hydopower Projects Recovery Plan Module. These survival estimates were: 0.962 for Wells Dam, 0.921 for Rocky Reach Dam, 0.934 for Rock Island Dam, 0.905 for Wanapum Dam and 0.905 Priest Rapids Dam.

In 2010, a total of 3,366,000 AD-clipped and 600,000 non-AD-clipped hatchery yearling summer Chinook salmon will be released in the Columbia River above McNary Dam. There are no listed summer Chinook salmon in the Columbia River. Because these fish may not be distinguishable from yearling spring Chinook salmon, they have been included in the yearling estimates detailed below. For the same reasons discussed under the Snake River section above, we were unable to estimate the number of holdover summer Chinook salmon outmigrating through the Columbia River.

Based on the assumptions stated above, we derived the estimates shown in Table 7a and 7b. Based on projected hatchery releases and the number of wild smolts we estimate will outmigrate from the various drainages along the Columbia River above McNary Dam, we estimate that 5,635,156 spring Chinook salmon will arrive at McNary Dam. The composition of fish arriving at McNary Dam will be as follows:

| | |
|---|---|
| Listed wild spring | 499,877 |
| Listed AD-clip hatchery spring | 242,854 |
| Listed Non-AD-clip hatchery spring | 590,100 |
| | |
| Unlisted wild spring | 666,188 |
| Unlisted AD-clip hatchery spring | 1,550,296 |
| Unlisted Non-AD-clip hatchery spring | 0 |
| Unlisted AD-clip hatchery yearling summer | 1,764,461 |

Note that the numbers shown for Columbia River dams above McNary Dam are numbers arriving at the dam and not the numbers collected at the dam. The reason for this is that fish guidance efficiency (FGE) for these dams is either unknown or is currently being evaluated.

**Estimate of Fish Arriving at McNary Dam**

McNary Dam is the first dam on the Columbia River below the confluence of the Snake River. To obtain an estimate of the number of spring/summer Chinook salmon smolts arriving at McNary Dam, we added the estimated numbers from the Columbia River above McNary Dam (5,635,156) and the Snake River (2,121,507).

We estimate that 7,756,663 (5,635,156 + 2,121,507) spring/summer Chinook salmon smolts will arrive at McNary Dam in 2010, and that 2,924,262 fish will be collected (FGE = 0.377). The collection at McNary Dam will be comprised of the following:

| | Snake R. ESU | Upper Col. R. ESU | Total | Percent |
|---|---|---|---|---|
| Listed groups | | | | |
| Wild spring/summer | 108,729 | 188,454 | 297,183 | 10.2 |
| AD-clip hatchery spring/summer | 162,970 | 91,556 | 254,526 | 8.7 |
| Non-AD-clip hatchery spring/summer | 59,625 | 222,468 | 282,093 | 9.6 |
| AD-clip hatchery yearling fall | 20,806 | 0 | 20,806 | 0.7 |
| Non-AD-clip hatchery yearling fall | 102,748 | 0 | 102,748 | 3.5 |
| Unlisted groups | | | | |
| Wild spring (from Mid-Columbia) | 0 | 251,153 | 251,153 | 8.6 |
| AD-clip hatchery spring/summer | 298,512 | 584,462 | 882,974 | 30.2 |
| Non-AD-clip hatchery spring/summer | 46,417 | 0 | 46,417 | 1.6 |
| AD-clip hatchery yearling Col. R. summer | 0 | 665,202 | 665,202 | 22.8 |
| Non-AD-clip hatchery Yearling Col. R. Summer | 0 | 121,160 | 121,160 | 4.1 |

The ratio of Upper Columbia River ESU wild spring Chinook salmon to Snake River ESU wild spring/summer Chinook salmon at McNary, John Day, and The Dalles Dams will be 0.634:0.366 (499,877:288,405). The proportion of Upper Columbia River ESU listed hatchery fish and Snake River ESU listed hatchery fish arriving at McNary, John Day, The Dalles, and Bonneville Dams will be as follows:

| | Ad-clipped | Non-AD-clipped |
|---|---|---|
| Snake R spring/summers | 0.592 (432,280) | 0.155 (158,157) |
| Snake R yearling falls | 0.076 (55,191) | 0.267 (272,541) |
| Upper Columbia R springs | 0.332 (242,854) | 0.578 (590,100) |
| | 1.000 | 1.000 |

We received some redd information from Oregon Department of Fish and Wildlife (ODFW) for the John Day River. Using the same redd to smolt calculation as described above (Upper Columbia River ESU, paragraph 2), we added 294,263 wild unlisted fish between arriving between McNary and John Day Dams. Hatchery releases between McNary and John Day Dams will total 600,000 (all AD-clipped) unlisted spring and 480,000 (50,000 AD-clipped and 430,000 non-AD-clipped) unlisted yearling fall Chinook salmon. We received 2008 redd count data for the Deschutes River from ODFW (Streamnet), which resulted in an estimated 82,294 wild unlisted fish being added between John Day and The Dalles Dams. Based on data from WDFW (Streamnet), we estimate that 36,338 wild unlisted spring Chinook salmon will be added (from the Klickitat River) between The Dalles and Bonneville Dams. Hatchery releases between John Day and The Dalles Dams will total 784,500 AD-clipped and 448,500 non-AD-clipped unlisted spring Chinook salmon. Hatchery releases between The Dalles and Bonneville Dams will total 2,838,719 (all AD-clipped) unlisted spring Chinook salmon.

**Lower Columbia River ESU**

The Lower Columbia River ESU extends from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. This ESU includes wild and hatchery spring-run and fall-run Chinook salmon. The fall-run fish will be discussed below under the subyearling fall Chinook salmon section. We have received information that spawning is

occurring in the Wind River, however, these spring Chinook are not considered to be part of the ESU even though they are naturally produced. We estimate that 37,590 wild spring Chinook salmon will be produced above Bonneville Dam. Also, 2,838,719 unlisted AD-clipped hatchery spring Chinook salmon will be released above Bonneville Dam. This ESU will introduce 2,548,565 wild, 3,091,527 listed hatchery (2,408,527 AD-clipped and 683,000 non-AD-clipped), and 1,275,000 (all AD-clipped) unlisted hatchery spring Chinook salmon to the Columbia River below Bonneville Dam.

**Estimate of Fish Arriving at Bonneville Dam**

At Bonneville Dam, the ratio of Upper Columbia River ESU, Snake River ESU, and Lower Columbia River ESU listed wild fish will be 0.595:0.344:0.061 (364,410:210,248:37,590).

Fish transported from Snake River dams and McNary Dam are released below Bonneville Dam. Transportation at McNary Dam does not occur during the spring migration; therefore, all transported fish are from the Snake River ESU. The number of listed transport fish returned to the river will be 3,895,161. The composition of these fish will be as follows:

| Snake River ESU (Total number = 3,895,161) | |
|---|---|
| Listed wild spring/summers | 1,135,537 |
| Listed AD-clip hatchery spring/summers | 1,951,372 |
| Listed Non-AD-clip hatchery spring/summers | 357,620 |
| Listed AD-clip hatchery yearling falls | 148,540 |
| Listed Non-AD-clip hatchery yearling falls | 302,092 |

A total of 8,135,855 (3,895,161 listed + 4,240,694 unlisted fish) transported yearling Chinook salmon will be released below Bonneville Dam.

**Upper Willamette River ESU**

The Upper Willamette River ESU contains spring Chinook salmon populations above Willamette Falls. This ESU will introduce 5,357,750 listed wild, 6,040,750 listed hatchery (5,990,750 AD-clipped and 50,000 Non-AD-clipped), and 240,000 unlisted hatchery (all AD-clipped) spring Chinook salmon to the Columbia River below Bonneville Dam.

The ratio of Upper Columbia River ESU, Snake River ESU, Lower Columbia River ESU, and Upper Willamette River ESU listed wild fish at Tongue Point will be 0.038:0.139:0.268:0.555 (364,410:1,345,785:2,586,155:5,357,750). The proportion of Upper Columbia River ESU, Snake River ESU, Lower Columbia River ESU, and Upper Willamette River ESU listed hatchery fish at Tongue Point will be as follows:

| | Ad-clipped | | Non-AD-clipped | |
|---|---|---|---|---|
| Upper Columbia R spring | 0.016 | (177,041) | 0.201 | (430,183) |
| Snake R spring/summer | 0.206 | (2,266,504) | 0.221 | (472,916) |
| Lower Columbia R spring | 0.218 | (2,408,527) | 0.320 | (683,000) |
| Upper Willamette R spring | 0.543 | (5,990,750) | 0.024 | (50,000) |
| Snake R yearling fall | 0.017 | (188,775) | 0.234 | (500,774) |
| | 1.000 | | 1.000 | |

The per-project survival estimate remained the same (0.900) (Table 2).

**Summary**

Tables 7a, 7b, 8a, and 8b present a summary of the estimated number of fish that will be collected, or will be arriving (Columbia River dams above McNary Dam), at each of the dams during 2010. This information is derived from the data shown in Tables 1-2 and Appendix Table A1. Table 11 shows the estimated number of listed spring, spring/summer, and yearling fall Chinook salmon expected to outmigrate from each ESU.

# COHO SALMON ESTIMATES

Lower Columbia River coho salmon were listed under the Endangered Species Act in June 2005. The Lower Columbia River ESU extends from the mouth of the Columbia River to the Big White Salmon River on the Washington State shore and the Hood River on the Oregon shore. It includes the Willamette River to Willamette Falls, Oregon. This ESU includes both wild and hatchery-origin coho salmon.

Hatchery coho salmon are released in the Snake River and the Columbia River above the Lower Columbia River ESU. At this time we have no estimates of wild coho salmon from these areas; therefore, we have included no wild information in Table 7c. As with yearling and subyearling Chinook salmon, hatchery fish must be tracked based on whether they have an adipose-fin clip.

We assigned coho salmon the same survival rates as yearling Chinook salmon in all our calculations. Enough coho have been released over the past couple years that we are able to estimate FGE at Lower Granite Dam at 0.391. Also, as with the other species discussed here, all our calculations are based on the "Transportation with Spill" scenario.

Based on hatchery outplanting records, we estimate that 963,610 hatchery coho salmon (87,000 AD-clipped and 876,610 non-AD-clipped) were released into the Snake River drainage. We estimate that 6,734,926 hatchery coho salmon (3,282,537 AD-clipped and 3,452,389 non-AD-clipped) were released into the Columbia River drainage above the Lower Columbia River ESU. From these releases, we estimate that 6,184,069 hatchery coho salmon (2,914,643 AD-clipped and 3,269,426 non-AD-clipped) will reach Tongue Point.

## Lower Columbia River ESU

With the June 2005 change in ESU listing status, all hatchery coho in this ESU are now listed (except those released at Youngs Bay, Tongue Point, and Blind Slough in Oregon and Deep River in Washington). We obtained wild and hatchery coho salmon production estimates for 2010 from the various agencies involved in the lower Columbia River system. From the information provided, we estimate that 95,646 listed wild coho salmon will

arrive at Bonneville Dam. No listed hatchery fish are released above Bonneville Dam.

Listed wild coho salmon estimates from below Bonneville Dam to Tongue Point are 1,067,388, while listed hatchery releases in this area are 8,697,463 (8,513,463 AD-clipped and 184,000 non-AD-clipped) and 1,660,000 unlisted (1,475,000 AD-clipped and 185,000 non-AD-clipped).

In addition, another 5,850 listed wild and 834,000 hatchery (9,000 listed AD-clipped and 825,000 unlisted AD-clipped) coho salmon will enter the Columbia River below Tongue Point.

**Summary**

Tables 7c, 8a, and 8b present a summary of the estimated number of fish that will be collected, or will be arriving, at various locations during 2010. Table 11 shows the estimated number of listed coho salmon expected to outmigrate from the Lower Columbia River ESU.

## SUBYEARLING FALL CHINOOK SALMON ESTIMATES

To estimate the 2010 collection number at Lower Granite Dam, we used the 2009 collection number and the adult returns over the dam for 2008 and 2009. In 2009, a total of 900,000 unmarked hatchery subyearling fall Chinook salmon were released above Lower Granite Dam. Assuming a survival rate of 0.832 (the estimated survival rate of hatchery subyearling fall Chinook salmon released above Lower Granite Dam in 2009), a total of 748,500 (900,000 x 0.832) of these fish would have arrived at Lower Granite Dam. Assuming an FGE of 0.308 (derived from PIT-tagged hatchery subyearling fall Chinook salmon in 2009), a total of 230,538 (748,500 x 0.308) would have been collected at Lower Granite Dam. Through December 31, 2009 a total of 313,791 unclipped (and without a coded-wire tag) subyearling Chinook salmon had been collected at Lower Granite Dam. By removing the estimated 230,538 unmarked hatchery subyearling fall Chinook salmon, we estimate that 83,253 (313,791 - 230,538) wild subyearling fall Chinook salmon were collected at Lower Granite Dam in 2009. These wild subyearling fall Chinook salmon were from the 2008 adult return. The adult count over Lower Granite Dam in 2008 was 16,628. Of these, 2,520 were hatchery fish that were returned to Lyons Ferry Hatchery and 14,108 adults were passed above Lower Granite Dam. The 2010 outmigration will be the result of the 2009 adults that passed over Lower Granite Dam. Through December 31, 2009, a total of 15,167 adults had been counted in the adult ladder. Of these, 1,716 fish were returned to Lyons Ferry Hatchery, leaving 13,451 adults that were passed above Lower Granite Dam. The 2009 count of 13,451 adults represents only 95.3% of the 2008 count (14,108). We applied this decrease (95.3%) to the 2009 subyearling collection number to arrive at the estimated 2010 collection number.

$$\left(\begin{array}{l}\text{total wild fall}\\ \text{Chinook}\\ \text{collected at}\\ \text{Granite}\end{array}\right) = \left(\begin{array}{l}\text{wild fall}\\ \text{Chinook}\\ \text{collected in}\\ \text{2009}\end{array}\right) \times \left(\begin{array}{l}\text{\% change between adult}\\ \text{counts for 2009 and 2010}\\ \text{outmigrations}\end{array}\right) =$$

$$79{,}340 = 83{,}253 \times 0.953$$

We estimated the total number of wild subyearling fall Chinook salmon arriving at Lower Granite Dam by dividing the number of wild fish collected by the FGE at Lower Granite Dam. The average estimated FGE for PIT-tagged hatchery subyearling fall Chinook salmon arriving at Lower Granite Dam from 2006-2009

(after onset of court ordered spill) is 0.19. Therefore, the total wild fall Chinook = total wild fall Chinook collected/FGE, or 417,579 fish (79,340/0.19).

The Nez Perce Tribe along with WDFW will release 6,640,000 listed subyearling fall Chinook salmon in the Clearwater and Snake Rivers in 2010. Of these fish, 3,210,000 will be AD-clipped and 3,430,000 will be non-AD-clipped. Assuming a survival rate of 0.521 (the average estimated survival rate of PIT-tagged hatchery subyearling fall Chinook salmon released above Lower Granite Dam from 1995-2009 (excluding 2001)), 3,459,440 (6,640,000 x 0.521) of the 6,640,000 hatchery fish will arrive at Lower Granite Dam. Of these fish, 1,672,410 will be AD-clipped and 1,787,030 will be non-AD-clipped. In 2010, NMFS, the U.S. Fish and Wildlife Service, and the Nez Perce Tribe will be conducting research using 326,330 hatchery subyearling fall Chinook salmon (all non-AD-clipped). Based on survival to Lower Granite Dam (0.521), 170,018 (326,330 x 0.521) will arrive at Lower Granite Dam. Combining the production and research non-AD-clipped fish, the total number of non-AD-clipped hatchery fish will be 1,957,048 (1,787,030 + 170,018). By adding the non-AD-clipped fish to the total number of wild fall Chinook salmon (417,579), we estimate that 2,374,627 non-AD-clipped subyearling fall Chinook salmon will arrive at Lower Granite Dam. The percentage of non-AD-clipped subyearling fall Chinook salmon that are wild will be 17.5850% (417,579/2,374,627). We added the total AD-clipped hatchery fish (1,672,410), the total non-AD-clipped hatchery fish (1,957,048), and the total wild fish (417,579) to determine the total number of subyearling fall Chinook salmon arriving at Lower Granite Dam (4,047,037).

Knowing the total number of hatchery fish, the number of listed hatchery fish, and the number of wild fish arriving at Lower Granite Dam, we estimated the percentage composition of listed hatchery fish and wild fish arriving at the dam as follows:

% listed fish = listed fish/total smolts =

| | |
|---|---|
| Wild subyearling fall | 10.3181% = 417,579/4,047,037 |
| AD-clip subyearling fall | 41.3243% = 1,672,410/4,047,037 |
| Non-AD-clip subyearling fall | 48.3576% = 1,957,048/4,047,037 |

We set FGEs at Lower Granite and Little Goose Dams to 0.190 and 0.288, respectively. Using an FGE of 0.190, the total

collection at Lower Granite Dam will be 768,937 (4,047,037 x 0.190), based on 4,047,037 smolts arriving at the dam. The collection at Lower Granite Dam will be comprised of the following:

| | |
|---|---|
| Listed wild subyearling fall | 79,340 |
| Listed AD-clip hatchery subyearling fall | 317,758 |
| Listed Non-AD-clip hatchery subyearling fall | 371,839 |

NMFS has conducted subyearling fall Chinook salmon survival tests since 1995. As part of these tests, we estimated actual FGEs for McNary Dam (factoring in effects of spill). To more accurately estimate the collection number at McNary Dam, we averaged these actual FGEs for 2006-2009 since the onset of court ordered spill. We also averaged the number of fall Chinook salmon adults crossing McNary Dam for each of the brood years (1997-2009) and the number of juvenile subyearling fall Chinook salmon collected at McNary Dam (1995-2009). The 2009 count of 104,684 adults represents 99.7% of the average for 1997-2009 count (104,987). We applied this change (99.7%) to the average 1997-2009 subyearling collection number (5,504,127) to arrive at an estimated 2010 collection number of 5,487,615 (5,504,127 x 0.997).

Based on the NMFS subyearling fall Chinook salmon survival studies conducted in 2006-2009, per-project survival was set at 75%. We set the FGEs at Little Goose, Lower Monumental, and McNary Dams, based on 2006-2009 NMFS fall Chinook salmon survival study results (since court ordered spill was initiated), to 0.288, 0.112, and 0.195, respectively.

**Lower Columbia River ESU**

The Lower Columbia River ESU includes both wild and hatchery tule and late-run bright fall Chinook salmon, including fall Chinook salmon from the Clackamas River.

To determine the number of wild outmigrants from this ESU, we assumed that 50% of the adults counted in the spawning areas were female and that every female spawned successfully. We used average fecundity and set the egg-to-smolt survival rate at 15%, the same used for spring/summer Chinook salmon.

Based on these assumptions, we estimate that 858,319 tule fall Chinook salmon will outmigrate from above Bonneville Dam. No late-run bright fish will enter the Columbia River above Bonneville Dam. Additionally, we estimate that 8,757,026 tule fall Chinook salmon and 3,571,125 late-run bright fall Chinook salmon will enter the Columbia River below Bonneville Dam.

The ratio of Snake River ESU and Lower Columbia River ESU (tule fall Chinook salmon) listed wild fish at Bonneville Dam will be 0.029:0.971 (26,033:858,319).

With the June 2005 change in ESA listing status, most hatchery fish released in this ESU are now listed. In 2010, hatchery releases above Bonneville Dam will total 12,553,917 listed tule (12,151,264 AD-clipped and 402,653 non-AD-clipped) and 8,516,182 unlisted (5,352,000 AD-clipped and 3,164,182 non-AD-clipped) subyearling fall Chinook salmon. Below Bonneville Dam releases totaled 19,780,000 listed tule (19,730,000 AD-clipped and 50,000 non-AD-clipped) and 9,141,500 unlisted (7,721,500 AD-clipped and 1,420,000 non-AD-clipped) subyearling fall Chinook salmon.

The ratio of Snake River ESU and Lower Columbia River ESU (tule fall Chinook salmon) listed hatchery AD-clipped fish at Bonneville Dam will be 0.010:0.990 (125,961:12,151,264), while the ratio for hatchery non-AD-clipped fish at Bonneville Dam will be 0.211:0.789 (107,698:402,653).

Fish transported from Snake River dams and McNary Dam are released below Bonneville Dam. The number of listed transport fish returned to the river will be 184,536 wild, 765,852 AD-clipped, and 847,189 non-AD-clipped fish, all from the Snake River ESU. A total of 7,136,081 transported subyearling fall Chinook salmon will be released below Bonneville Dam.

The ratio of Snake River ESU, Lower Columbia River ESU (tule fall Chinook salmon), and Lower Columbia River ESU (late-run bright fall Chinook salmon) listed wild fish at Tongue Point will be 0.016:0.718:0.266 (210,569:9,615,345:3,571,125). The proportion for hatchery fish at Tongue Point will be as follows:

| | Ad-clipped | | Non-AD-clipped | |
|---|---|---|---|---|
| Snake R. subyearling fall | 0.027 | (891,813) | 0.678 | (954,886) |
| Lower Columbia R. subyearling fall - Tule | 0.973 | (31,881,264) | 0.322 | (452,653) |
| Lower Columbia R. subyearling fall - Late run | 0.000 | (0) | 0.000 | (0) |
| | 1.000 | | 1.000 | |

**Summary**

Tables 7a, 7b, 8a, and 8b present a summary of the estimated number of fish that will be collected, or will be arriving (Columbia River dams above McNary Dam), at each of the dams during 2010. This information is derived from the data shown in Table 2. Table 11 shows the estimated number of subyearling fall Chinook salmon expected to outmigrate from each ESU.

## SOCKEYE SALMON ESTIMATES

The sockeye salmon collection count at Lower Granite Dam was based on IDFG's estimate of wild and hatchery-reared sockeye salmon smolts exiting the upper Salmon River in 2010 and IDFG and NOAA Fisheries estimates of survival to Lower Granite Dam. IDFG estimates that 17,757 wild fish and 160,713 hatchery fish that have overwintered in the lakes will survive to Lower Granite Dam in spring 2010. All of these fish are listed as endangered.

listed sockeye (wild and hatchery) to Lower Granite Dam =
IDFG's estimated wild fish + estimated hatchery fish =
178,470 = 17,757 + 160,713

To determine the percentage of wild sockeye salmon collected at Lower Granite Dam, we estimated the number of kokanee arriving at Lower Granite Dam. In 2009, WDFW staff at Lower Granite Dam estimated that 11,537 kokanee were collected. With an FGE of 0.236 (the 2009 estimate), 48,886 (11,537/0.236) kokanee reached Lower Granite Dam. Assuming the same amount of spill from Dworshak Dam in 2010 with a release of the same number of kokanee, we estimated the total number of wild *O. nerka* arriving at Lower Granite Dam to be 66,643 (48,886 + 17,757). We then estimated the percentage of wild *O. nerka* arriving at Lower Granite Dam that will be listed Snake River sockeye salmon.

% listed wild sockeye =
listed wild sockeye/total wild *O. nerka* to Lower Granite Dam =
26.6% = 17,757/66,643

A total of 227,356 (178,470 listed sockeye + 48,886 kokanee) *O. nerka* will arrive at Lower Granite Dam.

% total listed sockeye =
total listed sockeye/total *O. nerka* to Lower Granite Dam =
78.5% = 178,470/227,356

An FGE of 0.279 (average for 1998-2009 (excluding 2001)) was used to estimate the number of *O. nerka* smolts reaching Lower Granite Dam that will be collected.

*O. nerka* salmon collected = total *O. nerka* salmon x FGE =
63,432 = 227,356 x 0.279

Because of extreme year-to-year variability, the count used at McNary Dam for 2010 is based on the average of the counts at the dam from 1988 to 2009 (401,215). Project survival was set at the yearling Chinook salmon level (Table 2).

## Summary

Table 7c presents a summary of the estimated number of fish that will be collected, or will be arriving (Columbia River dams above McNary Dam), at each of the dams during 2010. This information is derived from the data shown in Table 2. Table 11 shows the estimated number of sockeye salmon expected to outmigrate from the Snake River ESU.

# STEELHEAD ESTIMATES

## Introduction

Because of the time of year that steelhead spawn, it is very difficult to obtain redd count information. All of our steelhead estimates, not otherwise explained, are based on adult counts in the spawning areas. We assumed that 65% of the adults were females and that every female spawned successfully. To estimate the number of outmigrants, we used average fecundity estimates, and assigned an egg-to-smolt survival rate of 1%. This survival rate is conservative as all rates we calculated or found in the literature were from 0.5% to 0.75%.

## Snake River Steelhead ESU

Prior to the 2001 outmigration, nearly all hatchery steelhead were fin-clipped, allowing us to use the juvenile collection numbers at Lower Granite Dam without making any adjustments for unclipped hatchery fish. Because it was known that a large number of unclipped steelhead were to be released for the 2009 outmigration, WDFW not only recorded the number of unclipped steelhead collected but also the number of unclipped steelhead that had fin erosion, a strong indicator that a fish is of hatchery origin. Based on the information provided by WDFW (Fred Mensik, WDFW, Pers. commun., March 2010), we determined that 397,657 wild steelhead were collected at Lower Granite Dam in 2009 (0.475, or 359,111, of the 756,768 unclipped steelhead collected at Lower Granite Dam in 2009 had fin erosion). We applied the 2009 estimated FGE (0.481) to the collection number to determine that 826,730 (397,657/0.481) wild steelhead arrived at Lower Granite Dam in 2009.

To our knowledge, no research has been conducted on the age-class distribution of migrating juvenile steelhead in the Snake River; however, there has been research on the mid-Columbia River (Pevan et al. 1994[1]). Pevan's research showed that in the mid-Columbia River, migrating steelhead were 0.7% age-1, 43.2% age-2, 46.4% age-3, and 8.6% age-4 smolts. The age-class of the

[1] Pevan, C. M., R. R. Whitney, and K. R. Williams. 1994. Age and length of steelhead smolts from the Mid-Columbia River Basin, Washington. N. Am. J. Fish. Manage. 14:77-86.

remainder of smolts (1.1%) was greater than age-4, up to age-7. Because of this age-class breakdown, we decided to base our estimates on age-classes 1 to 4. Because steelhead spawn in the spring, our annual counts were from July 1 to June 30, rather than by calendar year. Using the adult counts at Lower Granite Dam of the 4 years that comprised the 2009 wild smolt outmigration (2004-2008 brood years, July 1, 2003-June 30, 2008), and applying the smolt age-class percentages to the adult counts for each of these 4 years, we estimated that 37,669 of the adults passing Lower Granite Dam produced the 2009 steelhead outmigration. We performed the same calculation to estimate the number of adults from the 4 years (2005-2009 brood years) producing the 2010 wild outmigration. We calculated that the 2010 wild outmigration will be based on 88,882 adults, or 236% of the number of fish producing the 2009 outmigration. We applied the change in the number of adults to the number of wild steelhead that arrived at Lower Granite Dam in 2009 (826,730) to determine the estimated 2010 arrival number.

$$\left(\begin{array}{c}\text{total wild steelhead arriving at Lower Granite}\end{array}\right) = \left(\begin{array}{c}\text{wild steelhead arriving in 2009}\end{array}\right) \times \left(\begin{array}{c}\text{\% change between adult counts for 2009 and 2010 outmigrations}\end{array}\right) =$$

$$1{,}951{,}083 = 826{,}730 \times 2.360$$

For the steelhead hatchery release numbers, we used IDFG's, ODFW's, and WDFW's estimates of hatchery releases in Idaho, Oregon, and Washington. We estimate that 7,685,976 hatchery smolts (Table 4) will be released from Idaho (6,649,976), Oregon (876,000), and Washington (160,000 above Lower Granite Dam).

In order to estimate how many hatchery smolts will reach Lower Granite Dam, we attempted to use the survival estimates for the 2002-2009 outmigrations (from the NMFS survival study, Research Action #1212). Using the 2010 projected release number and survival estimate for each hatchery, we estimated how many total hatchery fish will arrive at Lower Granite Dam. We estimate that 6,066,706 or 78.9321% of the 7,685,976 hatchery fish released will arrive at the dam (Table 4).

Knowing the numbers of hatchery and wild fish arriving at Lower Granite Dam, we estimated the percentage composition of listed wild fish arriving at the dam as follows:

total smolts = total hatchery fish + wild fish =
8,017,789 = 6,066,706 + 1,951,083

% wild fish to Lower Granite Dam = wild fish/total smolts =
24.33443% = 1,951,083/8,017,789

% listed hatchery fish = listed hatchery fish/total smolts =

| | |
|---|---|
| AD-clip summer | 24.36311% = 1,953,383/8,017,789 |
| Non-AD-clip summer | 7.32497% = 587,301/8,017,789 |

We set FGEs at Lower Granite and Little Goose Dams at 0.431 and 0.547, respectively. Using an FGE of 0.431, the total collection at Lower Granite Dam will be 3,455,667 (8,017,789 x 0.431), based on 8,017,789 smolts arriving at the dam. The collection at Lower Granite Dam will be comprised of the following:

| | Number | Percent |
|---|---|---|
| Listed wild | 840,917 | 24.3 |
| Listed hatchery AD-clip | 841,908 | 24.4 |
| Listed hatchery Non-AD-clip | 253,127 | 7.3 |
| Unlisted hatchery AD-clip | 1,442,282 | 41.8 |
| Unlisted hatchery Non-AD-clip | 77,433 | 2.2 |

Wild/natural Tucannon River drainage fish are listed within the Snake River ESU. In spring 2010, 24,000 wild fish are expected to outmigrate from the Tucannon River. In addition, 55,000 (all Non-AD-clipped) listed hatchery fish and 160,000 (all AD-clipped) unlisted hatchery fish will be released into the Tucannon River or released directly from Lyons Ferry Hatchery. The Tucannon River joins the Snake River between Little Goose and Lower Monumental Dams. Because of the short distance from the confluence to Lower Monumental Dam, we assumed no mortality of these fish prior to Lower Monumental Dam. The estimates shown in Table 5 and Tables 9-10 reflect the addition of these fish above Lower Monumental Dam.

Except when research studies require an alternate disposition, all PIT-tagged fish bypassed at the collection dams (Lower Granite, Little Goose, Lower Monumental, and McNary Dams) are returned to the river to continue migrating inriver. This return of fish to the river requires adjustment of our estimates of the number of listed fish that reach McNary Dam. We

estimated the number of fish that will be PIT tagged for 2010 and, as described in Appendix B, adjusted for fish diverted to transportation at each Snake River collector dam. A detailed description of how we estimated the impact of returning PIT-tagged fish to the river is presented in Appendix B. We estimated that 10,516 PIT-tagged steelhead from the Snake River (including 4,107 wild fish) will be collected at McNary Dam because they were returned to the river at an upstream dam(s). These numbers represent collected fish. Dividing the collected number by the FGE at McNary Dam (0.221), we determined that 18,584 wild Snake River steelhead (4,107/0.221) will arrive at McNary Dam and must be added to the number of fish that were estimated to reach McNary Dam as a result of not having been collected at an upstream dam (column "Listed fish to McNary", Table 5).

**Upper-Columbia River ESU Steelhead**

Very little is known regarding wild steelhead in the Columbia River above the confluence with the Yakima River. Also, little is known regarding dam passage of smolts at the dams above McNary Dam. Because of this lack of information, the estimates of wild steelhead from the listed Upper Columbia River ESU are based on what little information is available and on broad generalizations based on this information. No FGE's have been established for the dams in this reach, so the numbers presented in this section of the memorandum (and in Tables 9 and 10) are the number of fish arriving at the dam, not collection numbers (unless otherwise noted in the text).

As mentioned above, Pevan et al. (1994) showed that migrating steelhead were 0.7% age-1, 43.2% age-2, 46.4% age-3, and 8.6% age-4 smolts. The age-class of the remainder of smolts (1.1%) was greater than age-4, up to age-7. Because of this age-class breakdown, we decided to base our estimates on age-classes 1 to 4.

We based our estimates of wild fish on counts collected at Rock Island Dam by the Fish Passage Center. During the 2009 outmigration, 8,121 wild steelhead smolts were counted in the Smolt Monitoring Program's sample. It is estimated that the sample represents 3-5% of the fish passing the dam. Using a 4% sample rate, we estimated that 203,025 wild steelhead passed Rock Island Dam in 2009.

We then examined the adult counts at Rock Island Dam. Because steelhead spawn in the spring, our annual counts were from July 1 to June 30, rather than by calendar year. Using the adult counts of the 4 years that comprised the 2009 wild smolt outmigration (2004-2008 brood years, July 1, 2003-June 30, 2008), and applying the smolt age-class percentages to the adult counts for each of these 4 years, we estimated that 11,041 of the adults passing Rock Island Dam produced the 2009 steelhead outmigration. We performed the same calculation to estimate the number of adults from the 4 years (2005-2009 brood years) producing the 2010 wild outmigration. We calculated that the 2010 wild outmigration will be based on 11,473 adults, or 1.039 of the number of fish producing the 2009 outmigration. We applied the change in the number of adults to the 2009 Rock Island Dam collection to arrive at the estimated 2010 collection number.

( total wild steelhead collected at Rock Island ) = ( wild steelhead collected in 2009 ) x ( % change between adult counts for 2009 and 2010 outmigrations ) =

8,438 = 8,121 x 1.039

Since this represents 4% of the fish passing the dam, we estimate that 210,950 wild steelhead smolts will pass the dam in 2010. Using the smolt age-class percentages, we estimate that 1,477 smolts will be age-1, 91,130 will be age-2, 97,881 will be age-3, and 18,142 will be age-4, and 2,320 will be age-5 and older.

To determine the number of wild smolts passing the two dams above Rock Island Dam (Rocky Reach and Wells Dams), we used the estimate of wild smolts passing Rock Island Dam (210,950) and the adult counts at all three dams.

By comparing the adult counts at each of the three dams for the 4 years that will produce the 2010 outmigration (2005-2009), we calculated the number of adults "lost" between each dam. We assigned this "loss" to adults migrating up rivers between the dams. The difference in adult counts between dams varied between years, so we applied the age-class percentages to each year's differences between dams to determine the number of wild smolts added from the rivers between the dams.

From Rock Island Dam to McNary Dam, the only adjustment made to the wild steelhead smolt count was for per-project survival.

To determine the number of hatchery smolts arriving at each dam in 2010, we used the outplanting data for the 3 years comprising the 2010 outmigration (2008-2010). Because hatchery fish are larger than equivalent age-class wild fish, we assigned age-2 status to hatchery fish released in 2010, age-3 to those released in 2009, and age-4 to those released in 2008. All of the hatchery outplants will be of listed hatchery stocks.

Because there are no survival data for the various hatcheries releasing fish in this section of the Columbia River, we assumed that all fish released survived to the first dam. We again applied the age-class percentages to the number of fish released each of the 3 years to determine the number of hatchery fish that would outmigrate in 2010. Beginning at Wells Dam and assuming 90% per-project survival, we determined both the number of listed hatchery and the total number of hatchery fish reaching each dam through McNary Dam (Tables 5 and 9).

**Mid-Columbia River ESU Steelhead**

The Mid-Columbia River wild summer-run and winter-run steelhead are listed protected species. With the January 2006 listings, some hatchery steelhead in this ESU are now listed. Only summer steelhead from the Yakima and Walla Walla Rivers enter the Columbia River above McNary Dam.

Based on our assumptions described in the steelhead introduction, 98,167 wild summer steelhead will enter above McNary Dam in 2010.

WDFW will release 55,600 (all non-AD-clipped) listed (from Touchet endemic stock) and 85,000 (all AD-clipped) unlisted hatchery steelhead (Lyons Ferry Hatchery stock) into the Touchet River, a tributary of the Walla Walla River. The Walla Walla River enters the Columbia River above McNary Dam. For these fish, survival to McNary Dam was set at 100%.

An additional 284,568 wild steelhead from this ESU will be added between McNary and John Day Dams. Hatchery summer steelhead will be released between McNary and John Day Dams. Release numbers will be as follows:

| | |
|---|---|
| Summer Steelhead | |
| Listed hatchery AD-clip | 150,000 |

Between John Day and The Dalles Dams, 209,901 wild and 813,900 (199,400 AD-clipped and 614,500 non-AD-clipped) listed hatchery summer steelhead will be added. Between The Dalles and Bonneville Dams, 105,218 wild winter, 114,000 (all AD-clipped) unlisted hatchery summer, and 20,000 (all AD-clipped) unlisted hatchery winter steelhead will be added.

**Estimate of Fish Arriving at McNary Dam**

McNary Dam is the first dam on the Columbia River below the confluence of the Snake River. To obtain an estimate of the number of steelhead smolts arriving at McNary Dam, we added the estimated numbers from the Upper Columbia River (1,176,080), Mid-Columbia (98,167) and the Snake River (859,774) ESUs.

We estimate that 2,134,021 (1,176,080 + 98,167 + 859,774) steelhead smolts will arrive at McNary Dam in 2010, and that 471,619 fish will be collected. Of the 471,619 smolts collected at McNary Dam, 103,280 (0.219) will be wild (33,310 Upper Columbia River ESU, 48,275 Snake River ESU, and 21,695 Mid-Columbia River ESU), 175,824 (0.373) will be listed hatchery AD-clipped (108,785 Upper Columbia River ESU, 44,939 Snake River ESU, and 22,100 Mid-Columbia River ESU), 80,502 (0.171) will be listed hatchery Non-AD-clipped (50,027 Upper Columbia River ESU, 18,187 Snake River ESU, and 12,288 Mid-Columbia River ESU), and 165,187 (0.35) will be unlisted hatchery fish (147,025 AD-clipped and 18,162 Non-AD-clipped). The ratio of Upper Columbia River ESU wild fish, Snake River ESU wild fish and Mid-Columbia River ESU wild fish at McNary, John Day, and The Dalles Dams will be as follows:

| | McNary Dam | | John Day | | The Dalles | |
|---|---|---|---|---|---|---|
| Upper Columbia | 0.323 | (150,722) | 0.200 | (135,650) | 0.153 | (122,085) |
| Snake River | 0.467 | (218,439) | 0.291 | (196,595) | 0.222 | (176,936) |
| Mid-Columbia | | | | | | |
| Summer | 0.210 | (98,167) | 0.509 | (344,462) | 0.625 | (498,927) |
| Winter | — | | — | | — | |
| | 1.000 | | 1.000 | | 1.000 | |

The proportion of Upper Columbia River ESU, Snake River ESU, and Mid-Columbia River ESU hatchery fish at McNary, John Day, and The Dalles Dams will be as follows:

| | McNary Dam | | John Day | | The Dalles | |
|---|---|---|---|---|---|---|
| Upper Columbia | | | | | | |
| AD-clipped | 0.619 | (492,241) | 0.512 | (443,017) | 0.407 | (398,715) |
| Non-AD-clipped | 0.621 | (226,367) | 0.621 | (203,730) | 0.202 | (183,357) |
| Snake River | | | | | | |
| AD-clipped | 0.256 | (203,342) | 0.211 | (183,008) | 0.168 | (164,707) |
| Non-AD-clipped | 0.226 | (82,294) | 0.226 | (74,065) | 0.073 | (66,659) |
| Mid-Columbia | | | | | | |
| Summer | | | | | | |
| AD-clipped | 0.126 | (100,000) | 0.277 | (240,000) | 0.424 | (415,400) |
| Non-AD-clipped | 0.153 | (55,600) | 0.153 | (50,040) | 0.725 | (659,536) |
| Winter | | | | | | |
| AD-clipped | 0.000 | (0) | 0.000 | (0) | 0.000 | (0) |
| Non-AD-clipped | 0.000 | (0) | 0.000 | (0) | 0.000 | (0) |

**Lower Columbia River ESU Steelhead**

We estimate that 39,920 (25,018 summer and 14,902 winter) wild steelhead from this ESU will arrive at Bonneville Dam. With the January 2006 listings, some hatchery steelhead in this ESU are now listed. Because the hatchery steelhead are denoted as of summer or winter stock, we have decided to track each run individually. At Bonneville Dam, the proportion of wild fish in the various ESUs will be as follows:

| | | |
|---|---|---|
| Upper Columbia | 0.127 | (109,877) |
| Snake River | 0.185 | (159,242) |
| Mid-Columbia | | |
| summer | 0.520 | (449,034) |
| winter | 0.122 | (105,218) |
| Lower Columbia | | |
| summer | 0.029 | (25,018) |
| winter | 0.017 | (14,902) |
| | 1.000 | |

Between The Dalles and Bonneville Dams, no hatchery summer steelhead will be added. There will be 50,000 AD-clipped winter steelhead released above Bonneville Dam from this ESU. At Bonneville Dam, the proportion of hatchery fish in the various ESUs will be as follows:

| | Bonneville Dam | |
|---|---|---|
| Upper Columbia | | |
| AD-clipped | 0.385 | (358,844) |
| Non-AD-clipped | 0.202 | (165,021) |
| Snake River | | |
| AD-clipped | 0.159 | (148,236) |
| Non-AD-clipped | 0.073 | (59,993) |
| Mid-Columbia | | |
| Summer | | |
| AD-clipped | 0.402 | (373,860) |
| Non-AD-clipped | 0.725 | (593,582) |
| Winter | | |
| AD-clipped | 0.000 | (0) |
| Non-AD-clipped | 0.000 | (0) |
| Lower Columbia | | |
| Summer | | |
| AD-clipped | 0.000 | (0) |
| Non-AD-clipped | 0.000 | (0) |
| Winter | | |
| AD-clipped | 0.054 | (50,000) |
| Non-AD-clipped | 0.000 | (0) |

Another 480,536 (37,917 summer and 442,619 winter) wild steelhead are expected to enter the Columbia River from Washington and Oregon downstream from Bonneville Dam.

Fish transported from Snake River dams are released below Bonneville Dam. The number of listed transport fish returned to the river will be 3,730,258 (1,616,239 wild, 1,605,400 AD-clipped hatchery, and 508,619 Non-AD-clipped hatchery), all from the Snake River ESU. A total of 6,520,355 transported steelhead will be released below Bonneville Dam.

**Upper Willamette River ESU**

The Upper Willamette River wild winter-run steelhead are listed protected species. With the January 2006 listings, some hatchery steelhead in this ESU are now listed. Because the hatchery steelhead are denoted as of summer or winter stock, we have decided to track each run individually.

Based on our assumptions described in the steelhead introduction, 320,586 winter steelhead will enter the Columbia River in 2010, 239,830 of which will be from listed stocks.

At Tongue Point the proportions of wild fish from the various ESUs will be as follows:

| | Tongue Point | |
|---|---|---|
| Upper Columbia | 0.034 | (109,877) |
| Snake River | 0.555 | (1,775,481) |
| Mid-Columbia | | |
| summer | 0.140 | (449,034) |
| winter | 0.033 | (105,218) |
| Lower Columbia | | |
| summer | 0.020 | (62,935) |
| winter | 0.143 | (457,521) |
| Upper Willamette | | |
| summer | 0 | (0) |
| winter | 0.075 | (239,830) |
| | 1.000 | |

Listed hatchery releases from this ESU will total 40,500 (all AD-clipped) summer steelhead. At Tongue Point the ratios of listed hatchery fish from the various ESUs will be as follows:

| | Tongue Point | |
|---|---|---|
| Upper Columbia | | |
| AD-clipped | 0.106 | (358,844) |
| Non-AD-clipped | 0.123 | (165,021) |
| Snake River | | |
| AD-clipped | 0.517 | (1,753,636) |
| Non-AD-clipped | 0.425 | (568,612) |
| Mid-Columbia | | |
| Summer | | |
| AD-clipped | 0.110 | (373,860) |
| Non-AD-clipped | 0.444 | (593,582) |
| Winter | | |
| AD-clipped | 0.000 | (0) |
| Non-AD-clipped | 0.000 | (0) |
| Lower Columbia | | |
| Summer | | |
| AD-clipped | 0.000 | (0) |
| Non-AD-clipped | 0.000 | (0) |
| Winter | | |
| AD-clipped | 0.255 | (866,500) |
| Non-AD-clipped | 0.007 | (10,000) |
| Upper Willamette | | |
| Summer | | |
| AD-clipped | 0.012 | (40,500) |
| Non-AD-clipped | 0.000 | (0) |
| Winter | | |
| AD-clipped | 0.000 | (0) |
| Non-AD-clipped | 0.000 | (0) |

## Summary

Tables 9 and 10 summarize the estimated number of steelhead that will be collected, or will be arriving (Columbia River dams above McNary Dam), at each of the collection dams during 2010. This information is derived from the data shown in Tables 4-5 and Appendix Table B1. Table 11 shows the estimated number of steelhead expected to outmigrate from each ESU.

# CHUM ESTIMATES

## Columbia River ESU

Wild and all hatchery chum salmon in the Columbia River are listed protected species.

To estimate wild chum salmon outmigration, we used a five year average (2004-08) of available adult data (Streamnet and Todd Hillson, WDFW, Pers. Commun., August 2010) for the Grays and lower Columbia river systems. We assumed 50% of the adults were females and that every female spawned successfully. To estimate the number of outmigrants, we used an average fecundity estimate of 3000, and assigned an egg-to-smolt rate of 0.15%. We estimate a total of 2,191,050 (1,581,300 Grays River and 609,750 Columbia River) wild chum salmon outmigrating in 2010.

We expect the hatchery (all non-AD-clipped) chum salmon outmigration to be 162,000 (27,000 from the Columbia River, 10,000 from Chinook River, and 125,000 from Grays River) This provides an overall estimate of 2,353,050 (2,191,050 + 162,000) listed chum salmon outmigrating in 2010.

## Full Transportation Scenario

The estimates shown in Table 3 were derived using the same methodology utilized under the Transportation with Spill Scenario, with one major difference. The number of fish removed at each dam under the Transportation with Spill Scenario was based on an FGE value that was adjusted for spill. For our estimates under the Full Transportation Scenario, we used the FGE values developed during developmental testing of the diversion screens installed in each of the turbine intakes. Using the results from these tests, the FGEs for spring/summer Chinook salmon and sockeye salmon were changed from the values in Table 2 to 60.0, 65.0, 50.0, and 80.0% at Lower Granite, Little Goose, Lower Monumental, and McNary Dams, respectively. Subyearling fall Chinook salmon FGEs were changed from the values in Table 2 to 55.0, 60.0, 40.0, and 65.0% at Lower Granite, Little Goose, Lower Monumental, and McNary Dams, respectively. Steelhead FGEs (in Table 6) were changed from the values in Table 5 to 80.0, 90.0, 65.0, and 90.0% at Lower Granite, Little Goose, Lower Monumental, and McNary Dams, respectively. Using the same formulas as under the Transportation with Spill Scenario, we derived the values found in Tables 3 and 6-10.

Because the adjusted FGE at Lower Granite Dam was changed from 39.1 to 60.0% for yearling spring/summer Chinook and sockeye salmon, the total number of fish collected at Lower Granite Dam will be 6,564,070 (10,940,117 x 0.600) spring/summer Chinook salmon and 136,414 (227,356 x 0.600) *O. nerka* salmon.

Because more PIT-tagged fish will be collected at the upstream dams, the number of PIT-tagged fish that are returned to the river and subsequently collected at McNary Dam will be different under this scenario. The effects of this are shown in Appendices A and B.

As under the Transportation with Spill Scenario, to estimate the number of spring/summer Chinook salmon smolts arriving at McNary Dam, we added the estimated numbers from the Columbia River above McNary (5,635,156) and the Snake River (908,506).

$$5,635,156 + 908,506 = 6,543,662$$

Tables 7-10 show the changes in percentages of listed fish at each dam.

Table 1. Estimated percentage composition of Snake River spring/summer Chinook salmon arriving at Lower Granite Dam from listed hatcheries compared with total hatchery releases projected for spring 2010.

| Hatchery | 2010 Total hatchery releases[a] | | Survival to Lower Granite Dam | Fish to Lower Granite Dam | |
|---|---|---|---|---|---|
| | AD-clipped | Non-AD-clipped | Mean[b] | AD-clipped | Non-AD-clipped |
| Dworshak[c] | 1,115,000 | 0 | 0.778 | 867,470 | 0 |
| Kooskia[c] | 229,600 | 0 | 0.663 | 152,225 | 0 |
| Lookingglass | | | | | |
| Imnaha[d] | 396,000 | 0 | 0.648 | 256,608 | 0 |
| Grande Ronde[d] | 789,000 | 104,400 | 0.546 | 430,794 | 57,002 |
| Clearwater[c] | 2,024,750 | 0 | 0.620 | 1,255,345 | 0 |
| Rapid River[c] | 3,230,000 | 0 | 0.686 | 2,215,780 | 0 |
| Sawtooth[d] | 1,661,900 | 201,900 | 0.455 | 756,165 | 91,865 |
| McCall[d] | 1,218,000 | 99,800 | 0.541 | 658,938 | 53,992 |
| Pahsimeroi[d] | 1,174,000 | 0 | 0.504 | 591,696 | 0 |
| Nez Perce[c] | 873,900 | 1,326,400 | 0.620 | 541,818 | 822,368 |
| Totals | | | | | |
| All stocks | 12,712,150 | 2,081,036 | | 7,726,839 | 1,241,319 |
| Listed stocks | 5,238,900 | 754,636 | | 2,694,201 | 418,951 |
| Percent of listed stocks | 40.51552% | | | 34.71339% | |

a Data from USFWS, NPT, IDFG and ODFW.

b Mean survival estimate made from PIT-tag detections of marked hatchery fish releases as part of the NMFS survival studies (Research Action #1212) for 1993-2009 (excluding 2001).

c Non-listed stocks in 2010.

d Listed stocks in 2010.

Table 2. Estimate of listed threatened and endangered species arriving at various locations during outmigration year 2010 under past transportation and spill conditions.

**Yearling spring/summer Chinook salmon**

*Snake River ESU*

| Rearing type | Total Collection* Granite | Total Collection* McNary | Of Granite Total % Listed Fish | Listed Fish to Granite[a] | FGE[1] Granite | FGE[1] Goose | FGE[1] Low Mon** | FGE[1] McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | Of Fish Collected at McNary % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild | 4,277,586 | 2,924,262 | 14.242 | 1,558,109 | 0.391 | 0.453 | 0.315 | 0.377 | 0.900 | 288,405 | 108,729 | 3.72 |
| Listed Hatchery*** AD-clipped | 4,277,586 | 2,924,262 | 24.627 | 2,694,201 | 0.391 | 0.453 | 0.315 | 0.377 | 0.900 | 432,280 | 162,970 | 5.57 |
| Non-AD-clipped | 4,277,586 | 2,924,262 | 3.830 | 418,951 | 0.391 | 0.453 | 0.315 | 0.377 | 0.900 | 158,157 | 59,625 | 2.04 |

*Upper Columbia River ESU*

| Rearing type | Number of listed fish passing dam Wells | Number of listed fish passing dam Rocky Reach | Number of listed fish passing dam Rock Island | Of dam total, % listed fish Wells | Of dam total, % listed fish Rocky Reach | Of dam total, % listed fish Rock Island | FGE McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | Of Fish Collected at McNary % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild**** | 133,594 | 187,878 | 678,147 | 5.8 | 5.9 | 12.1 | 0.377 | 0.900 | 499,877 | 188,454 | 6.44 |
| Listed Hatchery AD-clipped | 38,900 | 35,827 | 329,462 | 1.7 | 1.1 | 5.9 | 0.377 | 0.900 | 242,854 | 91,556 | 3.13 |
| Non-AD-clipped | 767,886 | 707,223 | 800,546 | 33.3 | 22.3 | 14.3 | 0.377 | 0.900 | 590,100 | 222,468 | 7.61 |

**Fall Chinook salmon**

| Rearing type | Total Collection* Granite | Total Collection* McNary | Of Granite Total % Listed Fish | Listed Fish to Granite[a] | FGE[1] Granite | FGE[1] Goose | FGE[1] Low Mon | FGE[1] McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | Of Fish Collected at McNary % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild**** | 768,937 | 5,487,615 | 10.318 | 417,580 | 0.190 | 0.288 | 0.112 | 0.195 | 0.75 | 76,656 | 14,948 | 0.27 |
| Listed Subyearling Hatchery AD-clipped | 768,937 | 5,487,615 | 41.324 | 1,672,410 | 0.190 | 0.288 | 0.112 | 0.195 | 0.75 | 370,898 | 72,325 | 1.32 |
| Non-AD-clipped | 768,937 | 5,487,615 | 48.358 | 1,957,048 | 0.190 | 0.288 | 0.112 | 0.195 | 0.75 | 317,121 | 61,839 | 1.13 |
| Listed Yearling Hatchery AD-clipped | 4,277,586 | 2,924,262 | 1.67585 | 183,340 | 0.391 | 0.453 | 0.315 | 0.377 | 0.900 | 55,191 | 20,807 | 0.71 |
| Non-AD-clipped | 4,277,586 | 2,924,262 | 2.10702 | 230,510 | 0.391 | 0.453 | 0.315 | 0.377 | 0.900 | 272,541 | 102,748 | 3.51 |

**Sockeye salmon**

| Rearing type | Total Collection* Granite | Total Collection* McNary | Of Granite Total % Listed Fish | Listed Fish to Granite[a] | FGE[1] Granite | FGE[1] Goose | FGE[1] Low Mon | FGE[1] McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | Of Fish Collected at McNary % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild and listed hatchery***** | 63,432 | 401,215 | 78.5 | 178,470 | 0.279 | 0.401 | 0.352 | 0.218 | 0.9 | 32,770 | 7,144 | 1.78 |

*Note:Total Collection is the total number of fish collected of that species or run, regardless of rearing type.

**Note: Listed wild and hatchery spring Chinook salmon enter the Snake River above Lower Monumental Dam. WDFW predicts that 22,286 wild and 172,000 listed hatchery (all non-AD-clipped) fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2010 (Michael Gallinat, WDFW, Pers. commun., February 2010)

***Note: Based on 2010 hatchery releases, it was estimated that 34.86809% and 33.75047% of the AD-clipped and non-AD-clipped, respectively, hatchery fish arriving at Lower Granite Dam are products of a listed hatchery (Table 1). Because Table 2 is based on the total collection at Lower Granite Dam, which includes both wild and hatchery (listed and unlisted) fish, these estimates of 34.86809% and 33.75047% of all hatchery fish were adjusted to % and % of the total collection at Lower Granite Dam.

****Note: Estimated values based on the average collection numbers from 1995-2009 (excluding 2001) (Fish Passage Center Weekly Reports), and on the average number of adult returns from 1994-2009 (excluding 2001) and the 2009 adult returns (FPC Weekly Reports 1994-2009).

*****Note: The Lower Granite Dam estimate is based on IDFG's estimate of 17,757 wild sockeye salmon smolts and 160,713 hatchery fish that overwintered in the lakes arriving at Lower Granite Dam in 2010 (Catherine Willard, IDFG, Pers. commun., February 2010). The McNary Dam estimate is the average collection count at McNary Dam from 1985-2009 (Annual Fish Passage Reports 1985-2009, and WDFW's 2009 fish counts).

1 The FGE used in this table is adjusted for spill conditions, and PIT-tag detection efficiency at a dam. This estimate was obtained from the NMFS survival studies conducted in 1995-2009 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., February 2010).

Formulas:

a) Listed fish to Granite = $((\text{Collection}_{\text{Granite}})/(\text{FGE}_{\text{Granite}}))$x(Of Granite Total % Listed Fish)

b) Listed Fish to McNary = (Listed Fish to Granite)x$(1-\text{FGE}_{\text{Granite}})$x(Project Survival)x$(1-\text{FGE}_{\text{Goose}})$x(Project Survival)x$(1-\text{FGE}_{\text{Low Mon}})$x$(\text{Project Survival})^2$ + (listed Tucannon fish)x$(1-\text{FGE}_{\text{Low Mon}})$x$(\text{Project Survival})^2$ +(PIT-tagged fish)

where: listed Tucannon fish = 22,286 wild and 172,000 hatchery (all non-AD-clipped)
PIT-tagged fish = fish collected at Snake River dams, returned to the river, and subsequently arrived at McNary Dam; See Appendix Table A1.

Table 3. Estimate of listed threatened and endangered species arriving at various locations during outmigration year 2010 under full transportation conditions (no spill).

**Yearling spring/summer Chinook salmon**

*Snake River ESU*

| Rearing type | Total Collection* Granite | Total Collection* McNary | Of Granite Total % Listed Fish | Listed Fish to Granite[a] | FGE Granite | FGE Goose | FGE Low Mon** | FGE McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | Of Fish Collected at McNary % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild | 6,564,070 | 5,234,930 | 14.242 | 1,558,109 | 0.60 | 0.65 | 0.50 | 0.80 | 0.900 | 133,563 | 106,850 | 2.04 |
| Listed Hatchery*** AD-clipped | 6,564,070 | 5,234,930 | 24.627 | 2,694,201 | 0.60 | 0.65 | 0.50 | 0.80 | 0.900 | 157,800 | 126,240 | 2.41 |
| Non-AD-clipped | 6,564,070 | 5,234,930 | 3.830 | 418,951 | 0.60 | 0.65 | 0.50 | 0.80 | 0.900 | 88,901 | 71,121 | 1.36 |

*Upper Columbia River ESU*

| Rearing type | Number of listed fish passing dam Wells | Number of listed fish passing dam Rocky Reach | Number of listed fish passing dam Rock Island | Of dam total, % listed fish Wells | Of dam total, % listed fish Rocky Reach | Of dam total, % listed fish Rock Island | FGE McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | Of Fish Collected at McNary % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild**** | 133,594 | 187,878 | 678,147 | 5.8 | 5.9 | 12.1 | 0.80 | 0.900 | 499,877 | 399,902 | 7.64 |
| Listed Hatchery AD-clipped | 38,900 | 35,827 | 329,462 | 1.7 | 1.1 | 5.9 | 0.80 | 0.900 | 242,854 | 194,283 | 3.71 |
| Non-AD-clipped | 767,886 | 707,223 | 800,546 | 33.3 | 22.3 | 14.3 | 0.80 | 0.900 | 590,100 | 472,080 | 9.02 |

**Subyearling fall Chinook salmon**

| Rearing type | Total Collection* Granite | Total Collection* McNary | Of Granite Total % Listed Fish | Listed Fish to Granite[a] | FGE Granite | FGE Goose | FGE Low Mon | FGE McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | Of Fish Collected at McNary % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild**** | 2,225,871 | 18,286,791 | 10.318 | 417,580 | 0.55 | 0.60 | 0.40 | 0.65 | 0.75 | 20,344 | 13,224 | 0.07 |
| Listed Subyearling Hatchery AD-clipped | 2,225,871 | 18,286,791 | 41.324 | 1,672,410 | 0.55 | 0.60 | 0.40 | 0.65 | 0.75 | 124,649 | 81,022 | 0.44 |
| Non-AD-clipped | 2,225,871 | 18,286,791 | 48.358 | 1,957,048 | 0.55 | 0.60 | 0.40 | 0.65 | 0.75 | 66,876 | 43,469 | 0.24 |
| Listed Yearling Hatchery AD-clipped | 6,564,070 | 5,234,930 | 1.67585 | 183,340 | 0.60 | 0.65 | 0.50 | 0.80 | 0.900 | 28,670 | 22,936 | 0.44 |
| Non-AD-clipped | 6,564,070 | 5,234,930 | 2.10702 | 230,510 | 0.60 | 0.65 | 0.50 | 0.80 | 0.900 | 184,332 | 147,466 | 2.82 |

**Sockeye salmon**

| Rearing type | Total Collection* Granite | Total Collection* McNary | Of Granite Total % Listed Fish | Listed Fish to Granite[a] | FGE Granite | FGE Goose | FGE Low Mon | FGE McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | Of Fish Collected at McNary % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild and listed hatchery***** | 136,414 | 401,215 | 78.5 | 178,470 | 0.60 | 0.65 | 0.50 | 0.80 | 0.900 | 8,197 | 6,557 | 1.63 |

*Note: Total Collection is the total number of fish collected of that species or run, regardless of rearing type.

**Note: Listed wild and hatchery spring Chinook salmon enter the Snake River above Lower Monumental Dam. WDFW predicts that 22,286 wild and 172,000 listed hatchery (all non-AD-clipped) fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2010 (Michael Gallinat, WDFW, Pers. commun., February 2010)

***Note: Based on 2010 hatchery releases, it was estimated that 34.86809% and 33.75047% of the AD-clipped and non-AD-clipped, respectively, hatchery fish arriving at Lower Granite Dam are products of a listed hatchery (Table 1). Because Table 2 is based on the total collection at Lower Granite Dam, which includes both wild and hatchery (listed and unlisted) fish, these estimates of 34.86809% and 33.75047% of all hatchery fish were adjusted to % and % of the total collection at Lower Granite Dam.

****Note: Estimated values based on the average collection numbers from 1995-2009 (excluding 2001) (Fish Passage Center Weekly Reports), and on the average number of adult returns from 1994-2009 (excluding 2001) and the 2009 adult returns (FPC Weekly Reports 1994-2009).

*****Note: The Lower Granite Dam estimate is based on IDFG's estimate of 17,757 wild sockeye salmon smolts and 160,713 hatchery fish that overwintered in the lakes arriving at Lower Granite Dam in 2010 (Catherine Willard, IDFG, Pers. commun., February 2010). The McNary Dam estimate is the average collection count at McNary Dam from 1985-2009 (Annual Fish Passage Reports 1985-2009, and WDFW's 2009 fish counts).

1 The FGE used in this table is adjusted for spill conditions, and PIT-tag detection efficiency at a dam. This estimate was obtained from the NMFS survival studies conducted in 1995-2009 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., February 2010).

Formulas:

a) Listed fish to Granite = $((\text{Collection}_{\text{Granite}})/(\text{FGE}_{\text{Granite}}))\text{x}(\text{Of Granite Total \% Listed Fish})$

b) Listed Fish to McNary = $(\text{Listed Fish to Granite})\text{x}(1-\text{FGE}_{\text{Granite}})\text{x}(\text{Project Survival})\text{x}(1-\text{FGE}_{\text{Goose}})\text{x}(\text{Project Survival})\text{x}(1-\text{FGE}_{\text{Low Mon}})\text{x}(\text{Project Survival})^2 +$
$(\text{listed Tucannon fish})\text{x}(1-\text{FGE}_{\text{Low Mon}})\text{x}(\text{Project Survival})^2 + (\text{PIT-tagged fish})$

where: listed Tucannon fish = 22,286 wild and 172,000 hatchery (all non-AD-clipped)
PIT-tagged fish = fish collected at Snake River dams, returned to the river, and subsequently arrived at McNary Dam; See Appendix Table A1.

Table 4. Estimated percentage composition of Snake River steelhead arriving at Lower Granite Dam from total hatchery releases projected for spring 2010.

| Hatchery | 2010 Total hatchery releases[a] AD-clipped | Non-AD-clipped | Survival to Lower Granite Dam Mean[b] | Fish to Lower Granite Dam AD-clipped | Non-AD-clipped |
|---|---|---|---|---|---|
| Dworshak[c] | 1,030,000 | 0 | 0.801 | 825,030 | 0 |
| Clearwater[c] | 331,500 | 552,800 | 0.75 | 248,625 | 414,600 |
| Hagerman[c,d] | 1,120,537 | 356,589 | 0.776 | 869,537 | 276,713 |
| Magic Valley[c,d] | 1,532,550 | 96,000 | 0.788 | 1,207,649 | 75,648 |
| Niagara Springs[d] | 1,630,000 | 0 | 0.834 | 1,359,420 | 0 |
| Irrigon (released above Lower Granite Dam)[c,d] | 876,000 | 0 | 0.769 | 673,644 | 0 |
| Lyons Ferry (released into Grande Ronde)[d] | 160,000 | 0 | 0.724 | 115,840 | 0 |
| Totals | | | | | |
| All stocks | 6,680,587 | 1,005,389 | | 5,299,745 | 766,961 |
| Listed stocks | 2,483,500 | 773,868 | | 1,953,383 | 587,301 |
| Percent of listed stocks | 42.38067% | | | 41.87914% | |

a Data from USFWS, IDFG, ODFW, and WDFW.

b Mean survival estimate made from PIT-tag detections of marked hatchery fish releases as part of the NMFS survival studies (Research Action #1212) for 1993-2009 (excluding 2001).

c Listed stocks in 2010.

d Un-listed stocks in 2010.

Table 5. Estimates of listed threatened and endangered steelhead arriving at various locations during outmigration year 2010 under past transportation and spill conditions.

*Snake River ESU*

| Rearing type | Total Collection* Granite | Total Collection* McNary | Of Granite Total % Listed Fish | Listed Fish to Granite[a] | FGE[1] Granite | FGE[1] Goose | FGE[1] Low Mon** | FGE[1] McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | Of Fish Collected at McNary % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild | 3,455,667 | 455,677 | 24.3344 | 1,951,083 | 0.431 | 0.547 | 0.428 | 0.221 | 0.9 | 218,439 | 48,275 | 10.59 |
| Listed Hatchery*** AD-clipped | 3,455,667 | 455,677 | 24.3631 | 1,953,383 | 0.431 | 0.547 | 0.428 | 0.221 | 0.9 | 203,342 | 44,939 | 9.86 |
| Non-AD-clipped | 3,455,667 | 455,677 | 7.3250 | 587,301 | 0.431 | 0.547 | 0.428 | 0.221 | 0.9 | 82,294 | 18,187 | 3.99 |

*Upper Columbia River ESU*

| Rearing type | Number of listed fish passing dam Wells | Number of listed fish passing dam Rocky Reach | Number of listed fish passing dam Rock Island | Of dam total, % listed fish Wells | Of dam total, % listed fish Rocky Reach | Of dam total, % listed fish Rock Island | FGE[1] McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | Of Fish Collected at McNary % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild*** | 123,260 | 161,465 | 210,950 | 23.1 | 29.1 | 27.2 | 0.221 | 0.9 | 150,722 | 33,310 | 7.31 |
| Listed Hatchery*** AD-clipped | 410,786 | 393,533 | 563,534 | 65.9 | 61.5 | 55.4 | 0.221 | 0.9 | 492,241 | 108,785 | 23.87 |
| Non-AD-clipped | 88,854 | 85,122 | 242,043 | 14.3 | 13.3 | 23.8 | 0.221 | 0.9 | 226,367 | 50,027 | 10.98 |

*Mid-Columbia River ESU*

| Rearing type | Total Collection* Granite | Total Collection* McNary | Of Granite Total % Listed Fish | Listed Fish to Granite[a] | FGE[1] Granite | FGE[1] Goose | FGE[1] Low Mon** | FGE[1] McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | Of Fish Collected at McNary % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Summer-run(First dam reached is McNary Dam) Wild | | | | | | | | 0.221 | 0.9 | 98,167 | 21,695 | 4.76 |
| Listed Hatchery*** AD-clipped | | | | | | | | 0.221 | 0.9 | 100,000 | 22,100 | 4.85 |
| Non-AD-clipped | | | | | | | | 0.221 | 0.9 | 55,600 | 12,288 | 2.70 |
| Winter-run(First dam reached is Bonneville Dam) Wild | | | | | | | | 0.221 | 0.9 | 0 | 0 | 0.00 |
| Listed Hatchery*** AD-clipped | | | | | | | | 0.221 | 0.9 | 0 | 0 | 0.00 |
| Non-AD-clipped | | | | | | | | 0.221 | 0.9 | 0 | 0 | 0.00 |

*Note: Total Collection is the total number of fish collected of that species or run, regardless of rearing type.

**Note: Hatchery steelhead and listed wild steelhead enter the Snake River above Lower Monumental Dam. WDFW predicts that 24,000 wild fish and 55,000 (all Non-AD-clipped) listed hatchery fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2010. An additional 155,600 (100,000 AD-clipped and 55,600 Non-AD-clipped) listed Mid-Columbia hatchery summer steelhead will outmigrate from the Touchet and Walla Walla Rivers above McNary Dam Michael Gillanat, WDFW, Pers. commun., February 2010).

***Note: Estimated values based on 2009 collection numbers (Fish Passage Center Weekly Reports), and on the number of adult returns from 1995-2009 (FPC Weekly Reports 1995-2009).

1 The FGE used in this table is adjusted for spill conditions, and PIT-tag detection efficiency at a dam. This estimate was obtained from the NMFS survival studies conducted in 1995-2009 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., February 2010).

Formulas:

a) Listed fish to Granite = $((\text{Collection}_{\text{Granite}})/(\text{FGE}_{\text{Granite}}))\text{x}(\text{Of Granite Total \% Listed Fish})$

b) Listed Fish to McNary = $(\text{Listed Fish to Granite})\text{x}(1-\text{FGE}_{\text{Granite}})\text{x}(\text{Project Survival})\text{x}(1-\text{FGE}_{\text{Goose}})\text{x}(\text{Project Survival})\text{x}(1-\text{FGE}_{\text{Low Mon}})\text{x}(\text{Project Survival})^2 +$
$(\text{listed Tucannon fish})\text{x}(1-\text{FGE}_{\text{Low Mon}})\text{x}(\text{Project Survival})^2 + (\text{Rock Island listed fish})\text{x}(\text{Project Survival})^2 + (\text{PIT-tagged fish})$

where: listed Tucannon fish = 24,000 wild and 55,000 (all Non-AD-clipped) hatchery fish
PIT-tagged fish = fish collected at Snake River dams, returned to the river, and subsequently arrived at McNary Dam; See Appendix Table B1.

Table 6. Estimates of listed threatened and endangered steelhead arriving at various locations during outmigration year 2010 under full transportation conditions (no spill).

*Snake River ESU*

| Rearing type | Total Collection* Granite | McNary | Of Granite Total % Listed Fish | Listed Fish to Granite[a] | FGE Granite | Goose | Low Mon** | McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild | 6,414,231 | 1,168,399 | 24.3344 | 1,951,083 | 0.80 | 0.90 | 0.65 | 0.90 | 0.90 | 39,474 | 35,527 | 3.04 |
| Listed Hatchery*** AD-clipped | 6,414,231 | 1,168,399 | 24.3631 | 1,953,383 | 0.80 | 0.90 | 0.65 | 0.90 | 0.90 | 26,415 | 23,774 | 2.03 |
| Non-AD-clipped | 6,414,231 | 1,168,399 | 7.3250 | 587,301 | 0.80 | 0.90 | 0.65 | 0.90 | 0.90 | 18,290 | 16,461 | 1.41 |

*Upper Columbia River ESU*

| Rearing type | Number of listed fish passing dam Wells | Rocky Reach | Rock Island | Of dam total, % listed fish Wells | Rocky Reach | Rock Island | FGE[1] McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild*** | 123,260 | 161,465 | 210,950 | 23.1 | 29.1 | 27.2 | 0.90 | 0.90 | 150,722 | 135,650 | 11.61 |
| Listed Hatchery*** AD-clipped | 410,786 | 393,533 | 563,534 | 65.9 | 61.5 | 55.4 | 0.90 | 0.90 | 492,241 | 443,017 | 37.92 |
| Non-AD-clipped | 88,854 | 85,122 | 242,043 | 14.3 | 13.3 | 23.8 | 0.90 | 0.90 | 226,367 | 203,730 | 17.44 |

*Mid-Columbia River ESU*

| Rearing type | Total Collection* Granite | McNary | Of Granite Total % Listed Fish | Listed Fish to Granite[a] | FGE[1] Granite | Goose | Low Mon** | McNary | Project Survival | Listed fish to McNary[b] | Of Fish Collected at McNary Listed Fish | % Listed Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Summer-run(First dam reached is McNary Dam) | | | | | | | | | | | | |
| Wild | | | | | | | | 0.90 | 0.90 | 98,167 | 88,350 | 7.56 |
| Listed Hatchery*** AD-clipped | | | | | | | | 0.90 | 0.90 | 100,000 | 90,000 | 7.70 |
| Non-AD-clipped | | | | | | | | 0.90 | 0.90 | 55,600 | 50,040 | 4.28 |
| Winter-run(First dam reached is Bonneville Dam) | | | | | | | | | | | | |
| Wild | | | | | | | | 0.90 | 0.90 | 0 | 0 | 0.00 |
| Listed Hatchery*** AD-clipped | | | | | | | | 0.90 | 0.90 | 0 | 0 | 0.00 |
| Non-AD-clipped | | | | | | | | 0.90 | 0.90 | 0 | 0 | 0.00 |

*Note: Total Collection is the total number of fish collected of that species or run, regardless of rearing type.

**Note: Hatchery steelhead and listed wild steelhead enter the Snake River above Lower Monumental Dam. WDFW predicts that 24,000 wild fish and 55,000 (all Non-AD-clipped) listed hatchery fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2010. An additional 155,600 (100,000 AD-clipped and 55,600 Non-AD-clipped) listed Mid-Columbia hatchery summer steelhead will outmigrate from the Touchet and Walla Walla Rivers above McNary Dam Michael Gillanat, WDFW, Pers. commun., February 2010).

***Note: Estimated values based on 2009 collection numbers (Fish Passage Center Weekly Reports), and on the number of adult returns from 1995-2009 (FPC Weekly Reports 1995-2009).

2 The FGE used in this table is adjusted for spill conditions, and PIT-tag detection efficiency at a dam. This estimate was obtained from the NMFS survival studies conducted in 1995-2009 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., February 2010).

Formulas:

a) Listed fish to Granite = $((\text{Collection}_{\text{Granite}})/(\text{FGE}_{\text{Granite}}))\text{x}(\text{Of Granite Total \% Listed Fish})$

b) Listed Fish to McNary = $(\text{Listed Fish to Granite})\text{x}(1-\text{FGE}_{\text{Granite}})\text{x}(\text{Project Survival})\text{x}(1-\text{FGE}_{\text{Goose}})\text{x}(\text{Project Survival})\text{x}(1-\text{FGE}_{\text{Low Mon}})\text{x}(\text{Project Survival})^2 +$
$(\text{listed Tucannon fish})\text{x}(1-\text{FGE}_{\text{Low Mon}})\text{x}(\text{Project Survival})^2 + (\text{Rock Island listed fish})\text{x}(\text{Project Survival})^2 + (\text{PIT-tagged fish})$

where: listed Tucannon fish = 24,000 wild and 55,000 (all Non-AD-clipped) hatchery fish
PIT-tagged fish = fish collected at Snake River dams, returned to the river, and subsequently arrived at McNary Dam; See Appendix Table B1.

Table 7a. Estimated juvenile Chinook salmon collection at each of eight mainstem collection facilities in 2010 under a full transportation scenario.

| | **Full Transportation Scenario** Chinook salmon | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Yearlings | | | | | Subyearlings | | |
| **Total fish collected at:*** | | | | | | | | |
| Lower Granite | 6,564,070 | | | | | 2,225,871 | | |
| Little Goose | 2,605,883 | | | | | 819,525 | | |
| Lower Monumental | 1,029,537 | | | | | 251,105 | | |
| Ice Harbor** | 605,671 | | | | | 127,122 | | |
| *Columbia River* | | | | | | | | |
| Wells*** | 2,308,882 | | | | | NA | | |
| Rocky Reach*** | 3,169,264 | | | | | NA | | |
| Rock Island*** | 5,610,361 | | | | | NA | | |
| Wanapum*** | 5,049,325 | | | | | NA | | |
| Priest Rapids*** | 4,544,393 | | | | | NA | | |
| McNary**** | 5,234,930 | | | | | 18,286,791 | | |
| John Day** **** | 4,358,136 | | | | | 2,794,768 | | |
| The Dalles** **** | 3,140,999 | | | | | 1,497,197 | | |
| Bonneville (I & II combined)** ***** | 3,977,423 | | | | | 7,926,003 | | |
| ---To the tailrace of Bonneville | 9,943,558 | | | | | 26,420,010 | | |
| ---To Tongue Point***** | 38,578,155 | | | | | 89,252,953 | | |
| | Spring/Summer Chinook | | | Fall Chinook - Yearlings | | Fall Chinook - Subyearlings | | |
| | | Hatchery | | Hatchery | | | Hatchery | |
| **Total listed fish at:** | Wild | Ad-clip | No Ad-clip | Ad-clip | No Ad-clip | Wild | Ad-clip | No Ad-clip |
| Lower Granite | 934,865 | 1,616,520 | 251,371 | 110,004 | 138,306 | 229,668 | 919,825 | 1,076,376 |
| Little Goose | 385,638 | 644,586 | 98,035 | 42,902 | 53,939 | 84,560 | 338,663 | 396,302 |
| Lower Monumental | 128,265 | 171,446 | 109,755 | 35,395 | 227,570 | 24,112 | 147,733 | 79,260 |
| Ice Harbor** | 89,042 | 105,200 | 59,268 | 19,113 | 122,888 | 12,207 | 74,790 | 40,125 |
| *Columbia River* | | | | | | | | |
| Wells*** | 133,594 | 38,900 | 767,886 | 0 | 0 | NA | NA | NA |
| Rocky Reach*** | 187,878 | 35,827 | 707,223 | 0 | 0 | NA | NA | NA |
| Rock Island*** | 678,147 | 329,462 | 800,546 | 0 | 0 | NA | NA | NA |
| Wanapum*** | 613,723 | 298,163 | 724,494 | 0 | 0 | NA | NA | NA |
| Priest Rapids*** | 555,419 | 269,838 | 655,667 | 0 | 0 | NA | NA | NA |
| McNary**** | 506,752 | 320,523 | 543,202 | 22,936 | 147,466 | 13,224 | 81,022 | 43,469 |
| John Day** **** | 342,058 | 216,353 | 366,661 | 15,482 | 99,540 | 1,869 | 11,452 | 6,144 |
| The Dalles** **** | 205,235 | 129,812 | 219,997 | 9,289 | 59,724 | 1,001 | 6,135 | 3,291 |
| Bonneville (I & II combined)** ***** | 199,747 | 116,831 | 197,997 | 8,360 | 53,752 | 258,397 | 3,650,901 | 123,758 |
| ---To the tailrace of Bonneville | 499,368 | 292,078 | 494,993 | 20,900 | 134,380 | 861,323 | 12,169,670 | 412,527 |
| ---To Tongue Point***** | 9,804,633 | 11,091,079 | 1,687,154 | 209,201 | 554,195 | 13,541,038 | 33,386,913 | 2,057,934 |
| **Percent listed fish at:** | | | | | | | | |
| Lower Granite | 14.24% | 24.63% | 3.83% | 1.68% | 2.11% | 10.32% | 41.32% | 48.36% |
| Little Goose | 14.80% | 24.74% | 3.76% | 1.65% | 2.07% | 10.32% | 41.32% | 48.36% |
| Lower Monumental | 12.46% | 16.65% | 10.66% | 3.44% | 22.10% | 9.60% | 58.83% | 31.56% |
| Ice Harbor** | 14.70% | 17.37% | 9.79% | 3.16% | 20.29% | 9.60% | 58.83% | 31.56% |
| *Columbia River* | | | | | | | | |
| Wells*** | 5.79% | 1.68% | 33.26% | 0.00% | 0.00% | NA | NA | NA |
| Rocky Reach*** | 5.93% | 1.13% | 22.32% | 0.00% | 0.00% | NA | NA | NA |
| Rock Island*** | 12.09% | 5.87% | 14.27% | 0.00% | 0.00% | NA | NA | NA |
| Wanapum*** | 12.15% | 5.91% | 14.35% | 0.00% | 0.00% | NA | NA | NA |
| Priest Rapids*** | 12.22% | 5.94% | 14.43% | 0.00% | 0.00% | NA | NA | NA |
| McNary**** | 9.68% | 6.12% | 10.38% | 0.44% | 2.82% | 0.07% | 0.44% | 0.24% |
| John Day** **** | 7.85% | 4.96% | 8.41% | 0.36% | 2.28% | 0.07% | 0.41% | 0.22% |
| The Dalles** **** | 6.53% | 4.13% | 7.00% | 0.30% | 1.90% | 0.07% | 0.41% | 0.22% |
| Bonneville (I & II combined)** ***** | 5.02% | 2.94% | 4.98% | 0.21% | 1.35% | 3.26% | 46.06% | 1.56% |
| ---To the tailrace of Bonneville | 5.02% | 2.94% | 4.98% | 0.21% | 1.35% | 3.26% | 46.06% | 1.56% |
| ---To Tongue Point***** | 25.41% | 28.75% | 4.37% | 0.54% | 1.44% | 15.17% | 37.41% | 2.31% |

* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.
** Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.
*** Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established. Also, there is no transportation from these dams.
**** Note: (See next page)
***** Note: (See next page)

**** Note: The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at McNary, John Day, and The Dalles Dams are:
**For example, If you handle 1,000 yearling Chinook salmon at Tongue Point, under the Full Transportation scenario (above),** 25.41% of them will be listed wild fish, or 254 fish. To these 254 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 254 x 0.1526 = 39; UCR, 254 x 0.0372 = 9; etc).

| **Yearling** | **Full Transportation** | | |
|---|---|---|---|
| **Chinook salmon** | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR - Spr/Sum | 21.09 | 36.75 | 10.30 |
| SR - Fall (Yrlg) | 0.00 | 6.68 | 21.35 |
| UCR | 78.91 | 56.57 | 68.35 |
| LCR - Spring | 0.00 | 0.00 | 0.00 |
| UWR | 0.00 | 0.00 | 0.00 |
| **Subyearling** | | | |
| **Chinook salmon** | | | |
| SR - Fall (Subyrlg) | 100.00 | 100.00 | 100.00 |
| LCR - Tule fall | 0.00 | 0.00 | 0.00 |
| LCR - Late run fall | 0.00 | 0.00 | 0.00 |

***** Note: Because the Columbia River is a free flowing river below Bonneville Dam and there are no survival estimates available, survival was set at 100% to Tongue Point.
The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at and downstream of Bonneville Dam are:

**Bonneville Dam**

| **Yearling** | **Full Transportation** | | |
|---|---|---|---|
| **Chinook salmon** | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR - Spr/Sum | 19.50 | 36.75 | 10.30 |
| SR - Fall (Yrlg) | 0.00 | 6.68 | 21.35 |
| UCR | 72.97 | 56.57 | 68.35 |
| LCR - Spring | 7.53 | 0.00 | 0.00 |
| UWR | 0.00 | 0.00 | 0.00 |
| **Subyearling** | | | |
| **Chinook salmon** | | | |
| SR - Fall (Subyrlg) | 0.35 | 0.15 | 2.39 |
| LCR - Tule fall | 99.65 | 99.85 | 97.61 |
| LCR - Late run fall | 0.00 | 0.00 | 0.00 |

**Tongue Point**

| **Yearling** | **Full Transportation** | | |
|---|---|---|---|
| **Chinook salmon** | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR - Spr/Sum | 15.26 | 22.25 | 23.38 |
| SR - Fall (Yrlg) | 0.00 | 1.85 | 24.73 |
| UCR | 3.72 | 1.57 | 19.19 |
| LCR - Spring | 26.38 | 21.31 | 30.47 |
| UWR | 54.64 | 53.02 | 2.23 |
| **Subyearling** | | | |
| **Chinook salmon** | | | |
| SR - Fall (Subyrlg) | 2.62 | 4.51 | 78.00 |
| LCR - Tule fall | 71.01 | 95.49 | 22.00 |
| LCR - Late run fall | 26.37 | 0.00 | 0.00 |

SR - Spr/Sum = Snake River ESU - Spring/Summer Chinook salmon
SR - Fall (Yrlg) = Snake River ESU - Yearling Fall Chinook salmon
SR - Fall (Subyrlg) = Snake River ESU - Subyearling Fall Chinook salmon
UCR = Upper Columbia River ESU
LCR - Spring = Lower Columbia River ESU - Spring Chinook salmon
UWR = Upper Willamette River ESU

LCR - Tule fall = Lower Columbia River ESU - Tule fall Chinook salmon
LCR - Late run fall = Lower Columbia River ESU - Late-run bright fall Chinook salmon

Table 7b. Estimated juvenile Chinook salmon collection at each of eight mainstem collection facilities in 2010 under a transportaion with spill scenario.

| | **Transportation with Spill Scenario** Chinook salmon | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Yearlings | | | | | Subyearlings | | |
| **Total fish collected at:*** | | | | | | | | |
| Lower Granite | 4,277,586 | | | | | 768,937 | | |
| Little Goose | 2,737,158 | | | | | 708,070 | | |
| Lower Monumental | 1,176,820 | | | | | 171,459 | | |
| Ice Harbor** | 1,414,335 | | | | | 458,806 | | |
| *Columbia River* | | | | | | | | |
| Wells*** | 2,308,882 | | | | | NA | | |
| Rocky Reach*** | 3,169,264 | | | | | NA | | |
| Rock Island*** | 5,610,361 | | | | | NA | | |
| Wanapum*** | 5,049,325 | | | | | NA | | |
| Priest Rapids*** | 4,544,393 | | | | | NA | | |
| McNary**** | 2,924,262 | | | | | 5,487,615 | | |
| John Day** **** | 1,228,223 | | | | | 4,010,634 | | |
| The Dalles** **** | 3,534,011 | | | | | 3,298,219 | | |
| Bonneville (I & II combined)** ***** | 1,905,699 | | | | | 5,059,869 | | |
| ---To the tailrace of Bonneville | 10,827,835 | | | | | 31,823,075 | | |
| ---To Tongue Point***** | 37,517,282 | | | | | 80,208,807 | | |
| | Spring/Summer Hatchery | | | Fall Chinook - Yearlings Hatchery | | Fall Chinook - Subyearlings Hatchery | | |
| **Total listed fish at:** | Wild | Ad-clip | No Ad-clip | Ad-clip | No Ad-clip | Wild | Ad-clip | No Ad-clip |
| Lower Granite | 609,221 | 1,053,433 | 163,810 | 71,686 | 90,130 | 79,340 | 317,758 | 371,839 |
| Little Goose | 396,417 | 675,366 | 104,021 | 45,521 | 57,234 | 73,060 | 292,605 | 342,405 |
| Lower Monumental | 153,122 | 238,228 | 89,789 | 31,333 | 154,728 | 17,188 | 83,164 | 71,106 |
| Ice Harbor** | 192,270 | 288,186 | 105,438 | 36,794 | 181,695 | 45,993 | 222,538 | 190,272 |
| *Columbia River* | | | | | | | | |
| Wells*** | 133,594 | 38,900 | 767,886 | 0 | 0 | NA | NA | NA |
| Rocky Reach*** | 187,878 | 35,827 | 707,223 | 0 | 0 | NA | NA | NA |
| Rock Island*** | 678,147 | 329,462 | 800,546 | 0 | 0 | NA | NA | NA |
| Wanapum*** | 613,723 | 298,163 | 724,494 | 0 | 0 | NA | NA | NA |
| Priest Rapids*** | 555,419 | 269,838 | 655,667 | 0 | 0 | NA | NA | NA |
| McNary**** | 297,183 | 254,526 | 282,093 | 20,807 | 102,748 | 14,948 | 72,325 | 61,838 |
| John Day** **** | 104,290 | 89,320 | 98,994 | 7,302 | 36,057 | 10,552 | 51,056 | 43,653 |
| The Dalles** **** | 255,404 | 218,743 | 242,434 | 17,882 | 88,303 | 8,678 | 41,987 | 35,899 |
| Bonneville (I & II combined)** ***** | 107,756 | 86,622 | 96,004 | 7,081 | 34,968 | 140,612 | 1,952,079 | 81,146 |
| ---To the tailrace of Bonneville | 612,250 | 492,170 | 545,477 | 40,233 | 198,682 | 884,352 | 12,277,226 | 510,352 |
| ---To Tongue Point***** | 9,654,102 | 10,842,819 | 1,636,097 | 188,773 | 500,774 | 13,397,039 | 32,773,078 | 1,407,540 |
| **Percent listed fish at:** | | | | | | | | |
| Lower Granite | 14.24% | 24.63% | 3.83% | 1.68% | 2.11% | 10.32% | 41.32% | 48.36% |
| Little Goose | 14.48% | 24.67% | 3.80% | 1.66% | 2.09% | 10.32% | 41.32% | 48.36% |
| Lower Monumental | 13.01% | 20.24% | 7.63% | 2.66% | 13.15% | 10.02% | 48.50% | 41.47% |
| Ice Harbor** | 13.59% | 20.38% | 7.45% | 2.60% | 12.85% | 10.02% | 48.50% | 41.47% |
| *Columbia River* | | | | | | | | |
| Wells*** | 5.79% | 1.68% | 33.26% | 0.00% | 0.00% | NA | NA | NA |
| Rocky Reach*** | 5.93% | 1.13% | 22.32% | 0.00% | 0.00% | NA | NA | NA |
| Rock Island*** | 12.09% | 5.87% | 14.27% | 0.00% | 0.00% | NA | NA | NA |
| Wanapum*** | 12.15% | 5.91% | 14.35% | 0.00% | 0.00% | NA | NA | NA |
| Priest Rapids*** | 12.22% | 5.94% | 14.43% | 0.00% | 0.00% | NA | NA | NA |
| McNary**** | 10.16% | 8.70% | 9.65% | 0.71% | 3.51% | 0.27% | 1.32% | 1.13% |
| John Day** **** | 8.49% | 7.27% | 8.06% | 0.59% | 2.94% | 0.26% | 1.27% | 1.09% |
| The Dalles** **** | 7.23% | 6.19% | 6.86% | 0.51% | 2.50% | 0.26% | 1.27% | 1.09% |
| Bonneville (I & II combined)** ***** | 5.65% | 4.55% | 5.04% | 0.37% | 1.83% | 2.78% | 38.58% | 1.60% |
| ---To the tailrace of Bonneville | 5.65% | 4.55% | 5.04% | 0.37% | 1.83% | 2.78% | 38.58% | 1.60% |
| ---To Tongue Point***** | 25.73% | 28.90% | 4.36% | 0.50% | 1.33% | 16.70% | 40.86% | 1.75% |

* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.
** Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.
*** Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established. Also, there is no transportation from these dams.
**** Note: (See next page)
***** Note: (See next page)

**** Note: The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at McNary, John Day, and The Dalles Dams are:
**For example, If you handle 1,000 yearling Chinook salmon at Tongue Point, under the Transportation with spill scenario (above),** 25.73% of them will be listed wild fish, or 257 fish. To these 257 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 257 x 0.1394 = 36; UCR, 257 x 0.0377 = 10; etc).

| **Yearling** | **Transportation with spill** | | |
|---|---|---|---|
| **Chinook salmon** | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR - Spr/Sum | 36.59 | 59.19 | 15.49 |
| SR - Fall (Yrlg) | 0.00 | 7.56 | 26.70 |
| UCR | 63.41 | 33.25 | 57.81 |
| LCR - Spring | 0.00 | 0.00 | 0.00 |
| UWR | 0.00 | 0.00 | 0.00 |
| **Subyearling** | | | |
| **Chinook salmon** | | | |
| SR - Fall (Subyrlg) | 100.00 | 100.00 | 100.00 |
| LCR - Tule fall | 0.00 | 0.00 | 0.00 |
| LCR - Late run fall | 0.00 | 0.00 | 0.00 |

***** Note: Because the Columbia River is a free flowing river below Bonneville Dam and there are no survival estimates available, survival was set at 100% to Tongue Point.
The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at and downstream of Bonneville Dam are:

**Bonneville Dam**

| **Yearling** | **Transportation with spill** | | |
|---|---|---|---|
| **Chinook salmon** | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR - Spr/Sum | 34.34 | 59.19 | 15.49 |
| SR - Fall (Yrlg) | 0.00 | 7.56 | 26.70 |
| UCR | 59.52 | 33.25 | 57.81 |
| LCR - Spring | 6.14 | 0.00 | 0.00 |
| UWR | 0.00 | 0.00 | 0.00 |
| **Subyearling** | | | |
| **Chinook salmon** | | | |
| SR - Fall (Subyrlg) | 2.94 | 1.03 | 21.10 |
| LCR - Tule fall | 97.06 | 98.97 | 78.90 |
| LCR - Late run fall | 0.00 | 0.00 | 0.00 |

**Tongue Point**

| **Yearling** | **Transportation with spill** | | |
|---|---|---|---|
| **Chinook salmon** | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR - Spr/Sum | 13.94 | 20.55 | 22.13 |
| SR - Fall (Yrlg) | 0.00 | 1.71 | 23.44 |
| UCR | 3.77 | 1.60 | 20.13 |
| LCR - Spring | 26.79 | 21.83 | 31.96 |
| UWR | 55.50 | 54.31 | 2.34 |
| **Subyearling** | | | |
| **Chinook salmon** | | | |
| SR - Fall (Subyrlg) | 1.57 | 2.72 | 67.84 |
| LCR - Tule fall | 71.77 | 97.28 | 32.16 |
| LCR - Late run fall | 26.66 | 0.00 | 0.00 |

SR - Spr/Sum = Snake River ESU - Spring/Summer Chinook salmon
SR - Fall (Yrlg) = Snake River ESU - Yearling Fall Chinook salmon
SR - Fall (Subyrlg) = Snake River ESU - Subyearling Fall Chinook salmon
UCR = Upper Columbia River ESU
LCR - Spring = Lower Columbia River ESU - Spring Chinook
UWR = Upper Willamette River ESU

LCR - Tule fall = Lower Columbia River ESU - Tule fall Chinook salmon
LCR - Late run fall = Lower Columbia River ESU - Late-run bright fall Chinook salmon

Table 7c. Estimated juvenile sockeye, coho, and chum salmon collection at each of eight mainstem collection facilities in 2010.

| | Full Transportation Scenario | | | | | Transportation with Spill Scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sockeye salmon | Coho salmon | | | Chum salmon | Sockeye salmon | Coho salmon | | | Chum salmon |
| **Total fish collected at:*** | | | | | | | | | | |
| Lower Granite | 136,414 | 358,463 | | | 0 | 63,432 | 233,598 | | | 0 |
| Little Goose | 53,201 | 139,801 | | | 0 | 59,160 | 148,337 | | | 0 |
| Lower Monumental | 12,891 | 33,875 | | | 0 | 27,996 | 50,780 | | | 0 |
| Ice Harbor** | 6,961 | 18,293 | | | 0 | 27,831 | 59,630 | | | 0 |
| *Columbia River* | | | | | | | | | | |
| Wells*** | NA | 548,197 | | | 0 | NA | 548,197 | | | 0 |
| Rocky Reach*** | NA | 493,377 | | | 0 | NA | 493,377 | | | 0 |
| Rock Island*** | NA | 1,554,233 | | | 0 | NA | 1,554,233 | | | 0 |
| Wanapum*** | NA | 1,398,810 | | | 0 | NA | 1,398,810 | | | 0 |
| Priest Rapids*** | NA | 1,258,929 | | | 0 | NA | 1,258,929 | | | 0 |
| McNary**** | 401,215 | 1,421,846 | | | 0 | 401,215 | 693,421 | | | 0 |
| John Day** **** | 993,835 | 1,559,746 | | | 0 | 202,080 | 390,341 | | | 0 |
| The Dalles** **** | 596,301 | 935,848 | | | 0 | 596,302 | 955,937 | | | 0 |
| Bonneville (I & II combined)** ***** | 536,671 | 2,250,180 | | | 12,000 | 238,819 | 998,034 | | | 12,000 |
| ---To the tailrace of Bonneville | 1,341,678 | 5,625,450 | | | 30,000 | 1,341,680 | 5,670,648 | | | 30,000 |
| ---To Tongue Point***** | 1,544,184 | 17,213,440 | | | 1,344,982 | 1,492,268 | 15,684,214 | | | 1,344,982 |
| | | Coho salmon | | | | | Coho salmon | | | |
| | Sockeye | | Hatchery | | Chum | Sockeye | | Hatchery | | Chum |
| **Total listed fish at:** | salmon | Wild | Ad-clip | No Ad-clip | salmon | salmon | Wild | Ad-clip | No Ad-clip | salmon |
| Lower Granite | 107,082 | 0 | 0 | 0 | 0 | 49,793 | 0 | 0 | 0 | 0 |
| Little Goose | 41,762 | 0 | 0 | 0 | 0 | 46,439 | 0 | 0 | 0 | 0 |
| Lower Monumental | 10,119 | 0 | 0 | 0 | 0 | 21,976 | 0 | 0 | 0 | 0 |
| Ice Harbor** | 5,464 | 0 | 0 | 0 | 0 | 21,846 | 0 | 0 | 0 | 0 |
| *Columbia River* | | | | | | | | | | |
| Wells*** | NA | 0 | 0 | 0 | 0 | NA | 0 | 0 | 0 | 0 |
| Rocky Reach*** | NA | 0 | 0 | 0 | 0 | NA | 0 | 0 | 0 | 0 |
| Rock Island*** | NA | 0 | 0 | 0 | 0 | NA | 0 | 0 | 0 | 0 |
| Wanapum*** | NA | 0 | 0 | 0 | 0 | NA | 0 | 0 | 0 | 0 |
| Priest Rapids*** | NA | 0 | 0 | 0 | 0 | NA | 0 | 0 | 0 | 0 |
| McNary**** | 6,557 | 0 | 0 | 0 | 0 | 7,144 | 0 | 0 | 0 | 0 |
| John Day** **** | 4,426 | 0 | 0 | 0 | 0 | 3,598 | 0 | 0 | 0 | 0 |
| The Dalles** **** | 2,656 | 0 | 0 | 0 | 0 | 10,617 | 0 | 0 | 0 | 0 |
| Bonneville (I & II combined)** ***** | 2,390 | 38,258 | 0 | 0 | 12,000 | 4,252 | 16,834 | 0 | 0 | 12,000 |
| ---To the tailrace of Bonneville | 5,975 | 95,645 | 0 | 0 | 30,000 | 23,888 | 95,648 | 0 | 0 | 30,000 |
| ---To Tongue Point***** | 171,495 | 1,163,033 | 8,513,463 | 184,000 | 1,344,982 | 142,096 | 1,163,036 | 8,513,463 | 184,000 | 1,344,982 |
| **Percent listed fish at:** | | | | | | | | | | |
| Lower Granite | 78.50% | 0.00% | 0.00% | 0.00% | ---- | 78.50% | 0.00% | 0.00% | 0.00% | ---- |
| Little Goose | 78.50% | 0.00% | 0.00% | 0.00% | ---- | 78.50% | 0.00% | 0.00% | 0.00% | ---- |
| Lower Monumental | 78.50% | 0.00% | 0.00% | 0.00% | ---- | 78.50% | 0.00% | 0.00% | 0.00% | ---- |
| Ice Harbor** | 78.49% | 0.00% | 0.00% | 0.00% | ---- | 78.50% | 0.00% | 0.00% | 0.00% | ---- |
| *Columbia River* | | 0.00% | 0.00% | 0.00% | | | 0.00% | 0.00% | 0.00% | |
| Wells*** | NA | 0.00% | 0.00% | 0.00% | ---- | NA | 0.00% | 0.00% | 0.00% | ---- |
| Rocky Reach*** | NA | 0.00% | 0.00% | 0.00% | ---- | NA | 0.00% | 0.00% | 0.00% | ---- |
| Rock Island*** | NA | 0.00% | 0.00% | 0.00% | ---- | NA | 0.00% | 0.00% | 0.00% | ---- |
| Wanapum*** | NA | 0.00% | 0.00% | 0.00% | ---- | NA | 0.00% | 0.00% | 0.00% | ---- |
| Priest Rapids*** | NA | 0.00% | 0.00% | 0.00% | ---- | NA | 0.00% | 0.00% | 0.00% | ---- |
| McNary**** | 1.63% | 0.00% | 0.00% | 0.00% | ---- | 1.78% | 0.00% | 0.00% | 0.00% | ---- |
| John Day** **** | 0.45% | 0.00% | 0.00% | 0.00% | ---- | 1.78% | 0.00% | 0.00% | 0.00% | ---- |
| The Dalles** **** | 0.45% | 0.00% | 0.00% | 0.00% | ---- | 1.78% | 0.00% | 0.00% | 0.00% | ---- |
| Bonneville (I & II combined)** ***** | 0.45% | 1.70% | 0.00% | 0.00% | ---- | 1.78% | 1.69% | 0.00% | 0.00% | ---- |
| ---To the tailrace of Bonneville | 0.45% | 1.70% | 0.00% | 0.00% | 100.00% | 1.78% | 1.69% | 0.00% | 0.00% | 100.00% |
| ---To Tongue Point***** | 11.11% | 6.76% | 49.46% | 1.07% | 100.00% | 9.52% | 7.42% | 54.28% | 1.17% | 100.00% |

* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.
** Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.
*** Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established. Also, there is no transportation from these dams.

Table 8a. Estimated juvenile salmon collection at each of the mainstem collection facilities in 2010 under a full transportation scenario. Percentage of listed fish at each facility.

****Use this table only if the reartype and/or clip/no-clip status of all handled fish is known****

| | Full Transportation Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Yearling Chinook salmon | | | | Coho salmon | | Subyearling Chinook salmon | |
| | Unclipped | | Clipped | | Unclipped | Clipped | Unclipped | Clipped |
| **Total fish collected at:*** | | | | | | | | |
| Lower Granite | 1,817,963 | | 4,746,107 | | 326,099 | 32,364 | 1,306,045 | 919,826 |
| Little Goose | 730,047 | | 1,875,837 | | 105,982 | 10,518 | 480,862 | 338,663 |
| Lower Monumental | 512,218 | | 517,319 | | 21,400 | 2,124 | 103,372 | 147,733 |
| Ice Harbor** | 296,376 | | 309,295 | | 9,630 | 956 | 52,332 | 74,790 |
| *Columbia River* | | | | | | | | |
| Wells*** | 901,480 | | 1,407,402 | | 548,197 | 0 | NA | NA |
| Rocky Reach*** | 1,361,901 | | 1,807,363 | | 493,377 | 0 | NA | NA |
| Rock Island*** | 1,914,684 | | 3,695,677 | | 1,554,234 | 0 | NA | NA |
| Wanapum*** | 1,723,216 | | 3,326,109 | | 1,398,810 | 0 | NA | NA |
| Priest Rapids*** | 1,550,894 | | 2,993,498 | | 1,258,929 | 0 | NA | NA |
| McNary**** | 2,005,246 | | 3,193,227 | | 1,121,238 | 286,279 | 17,414,995 | 871,796 |
| John Day** **** | 1,788,099 | | 2,545,428 | | 756,836 | 793,238 | 2,461,543 | 333,225 |
| The Dalles** **** | 1,285,177 | | 1,841,057 | | 454,102 | 475,943 | 1,318,684 | 178,513 |
| Bonneville (I & II combined)** ***** | 1,171,695 | | 2,792,439 | | 1,111,750 | 1,133,207 | 2,514,362 | 5,411,641 |
| ---To the tailrace of Bonneville | 2,929,238 | | 6,981,098 | | 2,779,375 | 2,833,018 | 8,381,207 | 18,038,803 |
| ---To Tongue Point***** | 11,184,077 | | 27,094,878 | | 5,790,482 | 13,152,766 | 41,484,632 | 47,768,321 |
| | Spring/Summer Chinook | | Fall Chinook | Spring/Summer Chinook | Fall Chinook | Coho salmon | | Coho salmon | Fall Chinook | | Fall Chinook |
| | | Hatchery | Hatchery | Hatchery | Hatchery | | Hatchery | Hatchery | | Hatchery | Hatchery |
| **Total listed fish at:** | Wild | No Ad-clip | No Ad-clip | Ad-clip | Ad-clip | Wild | No Ad-clip | Ad-clip | Wild | No Ad-clip | Ad-clip |
| Lower Granite | 934,865 | 251,371 | 138,306 | 1,616,520 | 110,004 | 0 | 0 | 0 | 229,668 | 1,076,376 | 919,825 |
| Little Goose | 385,638 | 98,035 | 53,939 | 644,586 | 42,902 | 0 | 0 | 0 | 84,560 | 396,302 | 338,663 |
| Lower Monumental | 128,265 | 109,755 | 227,570 | 171,446 | 35,395 | 0 | 0 | 0 | 24,112 | 79,260 | 147,733 |
| Ice Harbor** | 89,042 | 59,268 | 122,888 | 105,200 | 19,113 | 0 | 0 | 0 | 12,207 | 40,125 | 74,790 |
| *Columbia River* | | | | | | | | | | | |
| Wells*** | 133,594 | 767,886 | 0 | 38,900 | 0 | 0 | 0 | 0 | NA | NA | NA |
| Rocky Reach*** | 187,878 | 707,223 | 0 | 35,827 | 0 | 0 | 0 | 0 | NA | NA | NA |
| Rock Island*** | 678,147 | 800,546 | 0 | 329,462 | 0 | 0 | 0 | 0 | NA | NA | NA |
| Wanapum*** | 613,723 | 724,494 | 0 | 298,163 | 0 | 0 | 0 | 0 | NA | NA | NA |
| Priest Rapids*** | 555,419 | 655,667 | 0 | 269,838 | 0 | 0 | 0 | 0 | NA | NA | NA |
| McNary**** | 506,752 | 543,202 | 147,466 | 320,523 | 22,936 | 0 | 0 | 0 | 13,224 | 43,469 | 81,022 |
| John Day** **** | 342,058 | 366,661 | 99,540 | 216,353 | 15,482 | 0 | 0 | 0 | 1,869 | 6,144 | 11,452 |
| The Dalles** **** | 205,235 | 219,997 | 59,724 | 129,812 | 9,289 | 0 | 0 | 0 | 1,001 | 3,291 | 6,135 |
| Bonneville (I & II combined)** ***** | 199,747 | 197,997 | 53,752 | 116,831 | 8,360 | 38,258 | 0 | 0 | 258,397 | 123,758 | 3,650,901 |
| ---To the tailrace of Bonneville | 499,368 | 494,993 | 134,380 | 292,078 | 20,900 | 95,645 | 0 | 0 | 861,323 | 412,527 | 12,169,670 |
| ---To Tongue Point***** | 9,804,633 | 1,687,154 | 554,195 | 11,091,079 | 209,201 | 1,163,033 | 184,000 | 8,513,463 | 13,541,038 | 2,057,934 | 33,386,913 |
| **Percent listed fish at:** | | | | | | | | | | | |
| Lower Granite | 51.42% | 13.83% | 7.61% | 34.060% | 2.318% | 0.00% | 0.00% | 0.00% | 17.58% | 82.41% | 100.00% |
| Little Goose | 52.82% | 13.43% | 7.39% | 34.363% | 2.287% | 0.00% | 0.00% | 0.00% | 17.59% | 82.41% | 100.00% |
| Lower Monumental | 25.04% | 21.43% | 44.43% | 33.141% | 6.842% | 0.00% | 0.00% | 0.00% | 23.33% | 76.67% | 100.00% |
| Ice Harbor** | 30.04% | 20.00% | 41.46% | 34.013% | 6.180% | 0.00% | 0.00% | 0.00% | 23.33% | 76.67% | 100.00% |
| *Columbia River* | | | | | | | | | | | |
| Wells*** | 14.82% | 85.18% | 0.00% | 2.76% | 0.00% | NA | NA | NA | NA | NA | NA |
| Rocky Reach*** | 13.80% | 51.93% | 0.00% | 1.98% | 0.00% | NA | NA | NA | NA | NA | NA |
| Rock Island*** | 35.42% | 41.81% | 0.00% | 8.91% | 0.00% | NA | NA | NA | NA | NA | NA |
| Wanapum*** | 35.61% | 42.04% | 0.00% | 8.96% | 0.00% | NA | NA | NA | NA | NA | NA |
| Priest Rapids*** | 35.81% | 42.28% | 0.00% | 9.01% | 0.00% | NA | NA | NA | NA | NA | NA |
| McNary**** | 25.27% | 27.09% | 7.35% | 10.04% | 0.72% | 0.00% | 0.00% | 0.00% | 0.08% | 0.25% | 9.29% |
| John Day** **** | 19.13% | 20.51% | 5.57% | 8.50% | 0.61% | 0.00% | 0.00% | 0.00% | 0.08% | 0.25% | 3.44% |
| The Dalles** **** | 15.97% | 17.12% | 4.65% | 7.05% | 0.50% | 0.00% | 0.00% | 0.00% | 0.08% | 0.25% | 3.44% |
| Bonneville (I & II combined)** ***** | 17.05% | 16.90% | 4.59% | 4.18% | 0.30% | 3.44% | 0.00% | 0.00% | 10.28% | 4.92% | 67.46% |
| ---To the tailrace of Bonneville | 17.05% | 16.90% | 4.59% | 4.18% | 0.30% | 3.44% | 0.00% | 0.00% | 10.28% | 4.92% | 67.46% |
| ---To Tongue Point***** | 87.67% | 15.09% | 4.96% | 40.93% | 0.77% | 20.09% | 3.18% | 64.73% | 32.64% | 4.96% | 69.89% |

* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.

** Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.

*** Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established. Also, there is no transportation from these dams.

**** Note: (See next page)

***** Note: (See next page)

**** Note: The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at McNary, John Day, and The Dalles Dams are:
**For example, If you handle 1,000 yearling Chinook salmon at Tongue Point, under the Full Transportation scenario (above),**
87.67% of them will be listed wild fish, or 877 fish. To these 877 fish, apply the percentages
listed below under the Tongue Point section to determine how many are from each ESU
(SR, 877 x 0.1526 = 134; UCR, 877 x 0.0372 = 33; etc).

| **Spring/Summer** | **Full Transportation** | | |
|---|---|---|---|
| **Chinook salmon** | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR | 21.09 | 36.75 | 10.30 |
| SR - Fall (Yrlg) | 0.00 | 6.68 | 21.35 |
| UCR | 78.91 | 56.57 | 68.35 |
| LCR - Spring | 0.00 | 0.00 | 0.00 |
| UWR | 0.00 | 0.00 | 0.00 |
| | | | |
| **Fall** | | | |
| **Chinook salmon** | | | |
| SR | 100.00 | 100.00 | 100.00 |
| LCR - Tule fall | 0.00 | 0.00 | 0.00 |
| LCR - Late run fall | 0.00 | 0.00 | 0.00 |

***** Note:
Because the Columbia River is a free flowing river below Bonneville Dam and there are no survival estimates available, survival was set at 100% to Tongue Point.
The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at and downstream of Bonneville Dam are:

| **Bonneville Dam** | | | |
|---|---|---|---|
| **Spring/Summer** | **Full Transportation** | | |
| **Chinook salmon** | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR | 19.50 | 36.75 | 10.30 |
| SR - Fall (Yrlg) | 0.00 | 6.68 | 21.35 |
| UCR | 72.97 | 56.57 | 68.35 |
| LCR - Spring | 7.53 | 0.00 | 0.00 |
| UWR | 0.00 | 0.00 | 0.00 |
| | | | |
| **Fall** | | | |
| **Chinook salmon** | | | |
| SR | 0.35 | 0.15 | 2.39 |
| LCR - Tule fall | 99.65 | 99.85 | 97.61 |
| LCR - Late run fall | 0.00 | 0.00 | 0.00 |

| **Tongue Point** | | | |
|---|---|---|---|
| **Spring/Summer** | **Full Transportation** | | |
| **Chinook salmon** | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR | 15.26 | 22.25 | 23.38 |
| SR - Fall (Yrlg) | 0.00 | 1.85 | 24.73 |
| UCR | 3.72 | 1.57 | 19.19 |
| LCR - Spring | 26.38 | 21.31 | 30.47 |
| UWR | 54.64 | 53.02 | 2.23 |
| | | | |
| **Fall** | | | |
| **Chinook salmon** | | | |
| SR | 2.62 | 4.51 | 78.00 |
| LCR - Tule fall | 71.01 | 95.49 | 22.00 |
| LCR - Late run fall | 26.37 | 0.00 | 0.00 |

SR = Snake River ESU
UCR = Upper Columbia River ESU
LCR - Spring = Lower Columbia River ESU - Spring Chinook
UWR = Upper Willamette River ESU

LCR - Tule fall = Lower Columbia River ESU - Tule fall Chinook salmon
LCR - Late run fall = Lower Columbia River ESU - Late-run bright fall Chinook salmon

Table 8b. Estimated juvenile salmon collection at each of the mainstem collection facilities in 2010 under a transportation with spill scenario. Percentage of listed fish at each facility.

****Use this table only if the reartype and/or clip/no-clip status of all handled fish is known****

**Transportation with Spill Scenario**

| | Yearling Chinook salmon | | Coho salmon | | Subyearling Chinook salmon | |
|---|---|---|---|---|---|---|
| | Unclipped | Clipped | Unclipped | Clipped | Unclipped | Clipped |
| **Total fish collected at:*** | | | | | | |
| Lower Granite | 1,184,706 | 3,092,880 | 212,508 | 21,091 | 451,179 | 317,758 |
| Little Goose | 761,856 | 1,975,302 | 112,454 | 11,161 | 415,465 | 292,605 |
| Lower Monumental | 467,537 | 709,283 | 32,080 | 3,184 | 88,294 | 83,164 |
| Ice Harbor** | 561,483 | 852,853 | 31,393 | 3,116 | 236,265 | 222,538 |
| *Columbia River* | | | | | | |
| Wells*** | 901,480 | 1,407,402 | 548,197 | 0 | NA | NA |
| Rocky Reach*** | 1,361,901 | 1,807,363 | 493,377 | 0 | NA | NA |
| Rock Island*** | 1,914,684 | 3,695,677 | 1,554,234 | 0 | NA | NA |
| Wanapum*** | 1,723,216 | 3,326,109 | 1,398,810 | 0 | NA | NA |
| Priest Rapids*** | 1,550,894 | 2,993,498 | 1,258,929 | 0 | NA | NA |
| McNary**** | 1,094,890 | 1,812,191 | 535,768 | 135,642 | 5,226,001 | 261,614 |
| John Day** **** | 490,695 | 731,499 | 188,016 | 194,601 | 3,689,155 | 321,479 |
| The Dalles** **** | 1,414,020 | 2,105,226 | 460,447 | 476,574 | 3,033,845 | 264,374 |
| Bonneville (I & II combined)** ***** | 566,568 | 1,333,284 | 491,683 | 498,861 | 2,150,744 | 2,909,125 |
| ---To the tailrace of Bonneville | 3,219,136 | 7,575,477 | 2,793,653 | 2,834,438 | 13,526,692 | 18,296,384 |
| ---To Tongue Point***** | 9,970,344 | 25,021,565 | 5,122,851 | 12,993,979 | 33,505,782 | 46,703,025 |

| | Spring/Summer Chinook | | Fall Chinook | Spring/Summer Chinook | Fall Chinook | Coho salmon | | Coho salmon | Fall Chinook | | Fall Chinook |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Hatchery | Hatchery | Hatchery | Hatchery | Wild | Hatchery | Hatchery | Wild | Hatchery | Hatchery |
| **Total listed fish at:** | Wild | No Ad-clip | No Ad-clip | Ad-clip | Ad-clip | No Ad-clip | No Ad-clip | Ad-clip | No Ad-clip | No Ad-clip | Ad-clip |
| Lower Granite | 609,221 | 163,810 | 90,130 | 1,053,433 | 71,686 | 0 | 0 | 0 | 79,340 | 371,839 | 317,758 |
| Little Goose | 396,417 | 104,021 | 57,234 | 675,366 | 45,521 | 0 | 0 | 0 | 73,060 | 342,405 | 292,605 |
| Lower Monumental | 153,122 | 89,789 | 154,728 | 238,228 | 31,333 | 0 | 0 | 0 | 17,188 | 71,106 | 83,164 |
| Ice Harbor** | 192,270 | 105,438 | 181,695 | 288,186 | 36,794 | 0 | 0 | 0 | 45,993 | 190,272 | 222,538 |
| *Columbia River* | | | | | | | | | | | |
| Wells*** | 133,594 | 767,886 | 0 | 38,900 | 0 | 0 | 0 | 0 | NA | NA | NA |
| Rocky Reach*** | 187,878 | 707,223 | 0 | 35,827 | 0 | 0 | 0 | 0 | NA | NA | NA |
| Rock Island*** | 678,147 | 800,546 | 0 | 329,462 | 0 | 0 | 0 | 0 | NA | NA | NA |
| Wanapum*** | 613,723 | 724,494 | 0 | 298,163 | 0 | 0 | 0 | 0 | NA | NA | NA |
| Priest Rapids*** | 555,419 | 655,667 | 0 | 269,838 | 0 | 0 | 0 | 0 | NA | NA | NA |
| McNary**** | 297,183 | 282,093 | 102,748 | 254,526 | 20,807 | 0 | 0 | 0 | 14,948 | 61,838 | 72,325 |
| John Day** **** | 104,290 | 98,994 | 36,057 | 89,320 | 7,302 | 0 | 0 | 0 | 10,552 | 43,653 | 51,056 |
| The Dalles** **** | 255,404 | 242,434 | 88,303 | 218,743 | 17,882 | 0 | 0 | 0 | 8,678 | 35,899 | 41,987 |
| Bonneville (I & II combined)** ***** | 107,756 | 96,004 | 34,968 | 86,622 | 7,081 | 16,834 | 0 | 0 | 140,612 | 81,146 | 1,952,079 |
| ---To the tailrace of Bonneville | 612,250 | 545,477 | 198,682 | 492,170 | 40,233 | 95,648 | 0 | 0 | 884,352 | 510,352 | 12,277,226 |
| ---To Tongue Point***** | 9,654,102 | 1,636,097 | 500,774 | 10,842,819 | 188,773 | 1,163,036 | 184,000 | 8,513,463 | 13,397,039 | 1,407,540 | 32,773,078 |
| **Percent listed fish at:** | | | | | | | | | | | |
| Lower Granite | 51.42% | 13.83% | 7.61% | 34.06% | 2.32% | 0.00% | 0.00% | 0.00% | 17.59% | 82.41% | 100.00% |
| Little Goose | 52.03% | 13.65% | 7.51% | 34.19% | 2.31% | 0.00% | 0.00% | 0.00% | 17.59% | 82.41% | 100.00% |
| Lower Monumental | 32.75% | 19.20% | 33.09% | 33.59% | 4.42% | 0.00% | 0.00% | 0.00% | 19.47% | 80.53% | 100.00% |
| Ice Harbor** | 34.24% | 18.78% | 32.36% | 33.79% | 4.31% | 0.00% | 0.00% | 0.00% | 19.47% | 80.53% | 100.00% |
| *Columbia River* | | | | | | | | | | | |
| Wells*** | 14.82% | 85.18% | 0.00% | 2.76% | 0.00% | NA | NA | NA | NA | NA | NA |
| Rocky Reach*** | 13.80% | 51.93% | 0.00% | 1.98% | 0.00% | NA | NA | NA | NA | NA | NA |
| Rock Island*** | 35.42% | 41.81% | 0.00% | 8.91% | 0.00% | NA | NA | NA | NA | NA | NA |
| Wanapum*** | 35.61% | 42.04% | 0.00% | 8.96% | 0.00% | NA | NA | NA | NA | NA | NA |
| Priest Rapids*** | 35.81% | 42.28% | 0.00% | 9.01% | 0.00% | NA | NA | NA | NA | NA | NA |
| McNary**** | 27.14% | 25.76% | 9.38% | 14.05% | 1.15% | 0.00% | 0.00% | 0.00% | 0.29% | 1.18% | 27.65% |
| John Day** **** | 21.25% | 20.17% | 7.35% | 12.21% | 1.00% | 0.00% | 0.00% | 0.00% | 0.29% | 1.18% | 15.88% |
| The Dalles** **** | 18.06% | 17.15% | 6.24% | 10.39% | 0.85% | 0.00% | 0.00% | 0.00% | 0.29% | 1.18% | 15.88% |
| Bonneville (I & II combined)** ***** | 19.02% | 16.94% | 6.17% | 6.50% | 0.53% | 3.42% | 0.00% | 0.00% | 6.54% | 3.77% | 67.10% |
| ---To the tailrace of Bonneville | 19.02% | 16.94% | 6.17% | 6.50% | 0.53% | 3.42% | 0.00% | 0.00% | 6.54% | 3.77% | 67.10% |
| ---To Tongue Point***** | 96.83% | 16.41% | 5.02% | 43.33% | 0.75% | 22.70% | 3.59% | 65.52% | 39.98% | 4.20% | 70.17% |

* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.

** Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.

*** Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established. Also, there is no transportation from these dams.

**** Note: (See next page)

***** Note: (See next page)

**** Note: The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at McNary, John Day, and The Dalles Dams are:
**For example, If you handle 1,000 yearling Chinook salmon at Tongue Point, under the Transportation with spill scenario (above),** 96.83% of them will be listed wild fish, or 968 fish. To these 968 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 968 x 0.1394 = 135; UCR, 968 x 0.0377 = 36; etc).

| **Spring/Summer Chinook salmon** | **Transportation with spill** | | |
|---|---|---|---|
| | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR | 36.59 | 59.19 | 15.49 |
| SR - Fall (Yrlg) | 0.00 | 7.56 | 26.70 |
| UCR | 63.41 | 33.25 | 57.81 |
| LCR - Spring | 0.00 | 0.00 | 0.00 |
| UWR | 0.00 | 0.00 | 0.00 |
| | | | |
| **Fall Chinook salmon** | | | |
| SR | 100.00 | 100.00 | 100.00 |
| LCR - Tule fall | 0.00 | 0.00 | 0.00 |
| LCR - Late run fall | 0.00 | 0.00 | 0.00 |

***** Note:

Because the Columbia River is a free flowing river below Bonneville Dam and there are no survival estimates available, survival was set at 100% to Tongue Point.
The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at and downstream of Bonneville Dam are:

**Bonneville Dam**

| **Spring/Summer Chinook salmon** | **Transportation with spill** | | |
|---|---|---|---|
| | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR | 34.34 | 59.19 | 15.49 |
| SR - Fall (Yrlg) | 0.00 | 7.56 | 26.70 |
| UCR | 59.52 | 33.25 | 57.81 |
| LCR - Spring | 6.14 | 0.00 | 0.00 |
| UWR | 0.00 | 0.00 | 0.00 |
| | | | |
| **Fall Chinook salmon** | | | |
| SR | 2.94 | 1.03 | 21.10 |
| LCR - Tule fall | 97.06 | 98.97 | 78.90 |
| LCR - Late run fall | 0.00 | 0.00 | 0.00 |

**Tongue Point**

| **Spring/Summer Chinook salmon** | **Transportation with spill** | | |
|---|---|---|---|
| | | **Hatchery** | |
| | **Wild** | **Ad-clip** | **No Ad-clip** |
| SR | 13.94 | 20.55 | 22.13 |
| SR - Fall (Yrlg) | 0.00 | 1.71 | 23.44 |
| UCR | 3.77 | 1.60 | 20.13 |
| LCR - Spring | 26.79 | 21.83 | 31.96 |
| UWR | 55.50 | 54.31 | 2.34 |
| | | | |
| **Fall Chinook salmon** | | | |
| SR | 1.57 | 2.72 | 67.84 |
| LCR - Tule fall | 71.77 | 97.28 | 32.16 |
| LCR - Late run fall | 26.66 | 0.00 | 0.00 |

SR = Snake River ESU
UCR = Upper Columbia River ESU
LCR - Spring = Lower Columbia River ESU - Spring Chinook
UWR = Upper Willamette River ESU

LCR - Tule fall = Lower Columbia River ESU - Tule fall Chinook salmon
LCR - Late run fall = Lower Columbia River ESU - Late-run bright fall Chinook salmon

Table 9. Estimated juvenile steelhead trout collection at each of the mainstem collection facilities in 2010 under full transportation and transportation with spill scenarios.

| | Full Transportation Scenario | | | Transportation with SpillScenario | | |
|---|---|---|---|---|---|---|
| | Steelhead trout | | | Steelhead trout | | |
| **Total fish collected at:*** | | | | | | |
| *Snake River* | | | | | | |
| Lower Granite | 6,414,231 | | | 3,455,667 | | |
| Little Goose | 1,324,015 | | | 2,254,557 | | |
| Lower Monumental | 284,340 | | | 838,697 | | |
| Ice Harbor** | 136,174 | | | 778,251 | | |
| *Columbia River* | | | | | | |
| Wells*** | 622,900 | | | 622,900 | | |
| Rocky Reach*** | 640,120 | | | 640,120 | | |
| Rock Island*** | 1,016,527 | | | 1,016,527 | | |
| Wanapum*** | 914,874 | | | 914,874 | | |
| Priest Rapids*** | 823,387 | | | 823,387 | | |
| McNary**** | 1,511,059 | | | 541,174 | | |
| John Day** **** | 1,361,939 | | | 659,611 | | |
| The Dalles** **** | 1,387,433 | | | 1,699,200 | | |
| Bonneville (I & II combined)** ***** | 1,554,585 | | | 687,703 | | |
| ---To the tailrace of Bonneville | 2,826,518 | | | 3,387,700 | | |
| ---To Tongue Point**** | 14,963,000 | | | 14,091,647 | | |
| | Steelhead trout | | | Steelhead trout | | |
| **Total listed fish at:** | | Hatchery | | | Hatchery | |
| *Snake River* | Wild | Ad-clip | No Ad-clip | Wild | Ad-clip | No Ad-clip |
| Lower Granite | 1,560,866 | 1,562,706 | 469,841 | 840,917 | 841,908 | 253,127 |
| Little Goose | 320,503 | 327,973 | 95,143 | 547,985 | 550,953 | 164,514 |
| Lower Monumental | 53,886 | 33,715 | 41,934 | 192,067 | 180,719 | 76,021 |
| Ice Harbor** | 32,895 | 22,013 | 15,241 | 182,028 | 169,453 | 68,579 |
| *Columbia River* | | | | | | |
| Wells*** | 123,260 | 410,786 | 88,854 | 123,260 | 410,786 | 88,854 |
| Rocky Reach*** | 161,465 | 393,533 | 85,122 | 161,465 | 393,533 | 85,122 |
| Rock Island*** | 210,950 | 563,534 | 242,043 | 210,950 | 563,534 | 242,043 |
| Wanapum*** | 187,956 | 502,109 | 215,660 | 187,956 | 502,109 | 215,660 |
| Priest Rapids*** | 167,469 | 447,379 | 192,153 | 167,469 | 447,379 | 192,153 |
| McNary**** | 259,527 | 556,791 | 270,231 | 103,280 | 175,824 | 80,502 |
| John Day** **** | 380,867 | 494,754 | 189,162 | 176,291 | 216,506 | 81,959 |
| The Dalles** **** | 349,794 | 417,756 | 428,854 | 422,274 | 489,411 | 454,776 |
| Bonneville (I & II combined)** ***** | 426,122 | 413,578 | 424,565 | 183,762 | 178,831 | 166,175 |
| ---To the tailrace of Bonneville | 774,767 | 751,960 | 771,936 | 905,232 | 880,941 | 818,596 |
| ---To Tongue Point**** | 3,168,389 | 3,508,683 | 1,388,854 | 2,957,839 | 3,301,581 | 1,322,258 |
| **Percent listed fish at:** | | | | | | |
| *Snake River* | | | | | | |
| Lower Granite | 24.33% | 24.36% | 7.33% | 24.33% | 24.36% | 7.33% |
| Little Goose | 24.21% | 24.77% | 7.19% | 24.31% | 24.44% | 7.30% |
| Lower Monumental | 18.95% | 11.86% | 14.75% | 22.90% | 21.55% | 9.06% |
| Ice Harbor** | 24.16% | 16.17% | 11.19% | 23.39% | 21.77% | 8.81% |
| *Columbia River* | | | | | | |
| Wells*** | 19.79% | 65.95% | 14.27% | 19.79% | 65.95% | 14.27% |
| Rocky Reach*** | 25.22% | 61.48% | 13.30% | 25.22% | 61.48% | 13.30% |
| Rock Island*** | 20.75% | 55.44% | 23.81% | 20.75% | 55.44% | 23.81% |
| Wanapum*** | 20.54% | 54.88% | 23.57% | 20.54% | 54.88% | 23.57% |
| Priest Rapids*** | 20.34% | 54.33% | 23.34% | 20.34% | 54.33% | 23.34% |
| McNary**** | 17.18% | 36.85% | 17.88% | 19.08% | 32.49% | 14.88% |
| John Day** **** | 27.97% | 36.33% | 13.89% | 26.73% | 32.82% | 12.43% |
| The Dalles** **** | 25.21% | 30.11% | 30.91% | 24.85% | 28.80% | 26.76% |
| Bonneville (I & II combined)** ***** | 27.41% | 26.60% | 27.31% | 26.72% | 26.00% | 24.16% |
| ---To the tailrace of Bonneville | 27.41% | 26.60% | 27.31% | 26.72% | 26.00% | 24.16% |
| ---To Tongue Point**** | 21.18% | 23.45% | 9.28% | 20.99% | 23.43% | 9.38% |

* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.

** Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.

*** Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established at this time. Also, there is no transportation from these dams.

**** Note: (See next page)

**** Note: The percentage of listed wild and hatchery fish from each ESU at each Columbia River dam from McNary Dam to Bonneville Dam and at Tongue Point.

**For example** , If you handle 1,000 steelhead at Tongue Point, under the Full Transportation with spill scenario (above), 21.18% of them will be listed wild fish, or 212 fish. To these 212 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 212 x 0.5786 = 123; UCR, 212 x 0.0325 = 7; etc).

| | Full Transportation | | | Transportation with spill | | |
|---|---|---|---|---|---|---|
| | | Hatchery | | | Hatchery | |
| **McNary Dam** | **Wild** | **AD-clipped** | **No AD-clip** | **Wild** | **AD-clipped** | **No AD-clip** |
| SR | 13.69 | 4.27 | 6.09 | 46.74 | 25.56 | 22.59 |
| UCR | 52.27 | 79.57 | 75.39 | 32.25 | 61.87 | 62.15 |
| MCR - Summer | 34.04 | 16.16 | 18.52 | 21.01 | 0.00 | 15.26 |
| MCR - Winter | --- | --- | --- | --- | --- | --- |
| LCR - Summer | --- | --- | --- | --- | --- | --- |
| LCR - Winter | --- | --- | --- | --- | --- | --- |
| UWR - Summer | --- | --- | --- | --- | --- | --- |
| UWR - Winter | --- | --- | --- | --- | --- | --- |
| **John Day Dam** | | | | | | |
| SR | 6.89 | 3.36 | 6.09 | 29.05 | 21.13 | 22.59 |
| UCR | 26.31 | 62.68 | 75.39 | 20.05 | 51.16 | 62.15 |
| MCR - Summer | 66.80 | 33.96 | 18.52 | 50.90 | 27.71 | 15.26 |
| MCR - Winter | --- | 0.00 | 0.00 | --- | 0.00 | 0.00 |
| LCR - Summer | --- | --- | --- | --- | --- | --- |
| LCR - Winter | --- | --- | --- | --- | --- | --- |
| UWR - Summer | --- | --- | --- | --- | --- | --- |
| UWR - Winter | --- | --- | --- | --- | --- | --- |
| **The Dalles Dam** | | | | | | |
| SR | 4.90 | 2.56 | 1.73 | 22.17 | 16.83 | 7.33 |
| UCR | 18.69 | 47.72 | 21.38 | 15.30 | 40.73 | 20.16 |
| MCR - Summer | 76.41 | 49.72 | 76.89 | 62.53 | 42.44 | 72.51 |
| MCR - Winter | --- | 0.00 | 0.00 | --- | 0.00 | 0.00 |
| LCR - Summer | --- | --- | --- | --- | --- | --- |
| LCR - Winter | --- | --- | --- | --- | --- | --- |
| UWR - Summer | --- | --- | --- | --- | --- | --- |
| UWR - Winter | --- | --- | --- | --- | --- | --- |
| **Bonneville Dam** | | | | | | |
| SR | 3.93 | 2.40 | 1.73 | 18.44 | 15.92 | 7.33 |
| UCR | 14.99 | 44.75 | 21.38 | 12.73 | 38.55 | 20.16 |
| MCR - Summer | 61.28 | 46.62 | 76.89 | 52.01 | 40.16 | 72.51 |
| MCR - Winter | 14.36 | 0.00 | 0.00 | 12.19 | 0.00 | 0.00 |
| LCR - Summer | 3.41 | 0.00 | 0.00 | 2.90 | 0.00 | 0.00 |
| LCR - Winter | 2.03 | 6.23 | 0.00 | 1.73 | 5.37 | 0.00 |
| UWR - Summer | --- | --- | --- | --- | --- | --- |
| UWR - Winter | --- | --- | --- | --- | --- | --- |
| **Tongue Point** | | | | | | |
| SR | 57.86 | 53.62 | 45.31 | 55.49 | 51.68 | 42.52 |
| UCR | 3.25 | 9.90 | 11.74 | 3.43 | 10.57 | 12.34 |
| MCR - Summer | 13.28 | 10.32 | 42.24 | 14.03 | 11.02 | 44.39 |
| MCR - Winter | 3.11 | 0.00 | 0.00 | 3.29 | 0.00 | 0.00 |
| LCR - Summer | 1.86 | 1.12 | 0.00 | 1.97 | 0.00 | 0.00 |
| LCR - Winter | 13.54 | 23.92 | 0.71 | 14.30 | 25.54 | 0.75 |
| UWR - Summer | --- | 1.12 | 0.00 | --- | 1.19 | 0.00 |
| UWR - Winter | 7.10 | 0.00 | 0.00 | 7.49 | 0.00 | 0.00 |

SR = Snake River ESU
UCR = Upper Columbia River ESU
MCR - Summer = Mid Columbia River ESU summer steelhead
MCR - Winter = Mid Columbia River ESU winter steelhead
LCR - Summer = Lower Columbia River ESU summer steelhead
LCR - Winter = Lower Columbia River ESU winter steelhead
UWR - Summer = Upper Willamette River ESU summer steelhead
UWR - Winter = Upper Willamette River ESU winter steelhead

Table 10. Estimated juvenile steelhead trout collection at each of the mainstem collection facilities in 2010 under full transportation and transportation with spill scenarios. Percentage of listed fish by rearing type (wild or hatchery) at each facility.

****Use this table only if the reartype and/or clip/no-clip status of all handled fish is known****

| | Full Transportation Scenario Steelhead trout | | | Transportation with Spill Scenario Steelhead trout | | |
|---|---|---|---|---|---|---|
| | Unclipped | | Clipped | Unclipped | | Clipped |
| **Total fish collected at:*** | | | | | | |
| *Snake River* | | | | | | |
| Lower Granite | 2,174,435 | | 4,239,796 | 1,171,477 | | 2,284,190 |
| Little Goose | 444,751 | | 870,084 | 762,825 | | 1,488,332 |
| Lower Monumental | 97,712 | | 172,952 | 284,142 | | 548,227 |
| Ice Harbor** | 48,824 | | 72,620 | 265,089 | | 500,983 |
| *Columbia River* | | | | | | |
| Wells*** | 212,114 | | 410,786 | 212,114 | | 410,786 |
| Rocky Reach*** | 246,587 | | 393,533 | 246,587 | | 393,533 |
| Rock Island*** | 452,993 | | 563,534 | 452,993 | | 563,534 |
| Wanapum*** | 407,694 | | 507,181 | 407,694 | | 507,181 |
| Priest Rapids*** | 366,925 | | 456,463 | 366,925 | | 456,463 |
| McNary**** | 588,820 | | 905,702 | 201,942 | | 336,002 |
| John Day** **** | 611,372 | | 738,991 | 276,739 | | 379,583 |
| The Dalles** **** | 805,225 | | 574,766 | 910,331 | | 782,949 |
| Bonneville (I & II combined)** ***** | 876,999 | | 670,218 | 362,098 | | 323,442 |
| ---To the tailrace of Bonneville | 1,594,544 | | 1,218,578 | 1,783,734 | | 1,593,310 |
| ---To Tongue Point****** | 5,134,695 | | 10,054,739 | 4,838,702 | | 9,482,119 |
| **Total listed fish at:** | | | | | | |
| *Snake River* | Wild | Hatchery No Ad-clip | Hatchery Ad-clip | Wild | Hatchery No Ad-clip | Hatchery Ad-clip |
| Lower Granite | 1,560,866 | 469,841 | 1,562,706 | 840,917 | 253,127 | 841,908 |
| Little Goose | 320,503 | 95,143 | 327,973 | 547,985 | 164,514 | 550,953 |
| Lower Monumental | 53,886 | 41,934 | 33,715 | 192,067 | 76,021 | 180,719 |
| Ice Harbor** | 32,895 | 15,241 | 22,013 | 182,028 | 68,579 | 169,453 |
| *Columbia River* | | | | | | |
| Wells*** | 123,260 | 88,854 | 410,786 | 123,260 | 88,854 | 410,786 |
| Rocky Reach*** | 161,465 | 85,122 | 393,533 | 161,465 | 85,122 | 393,533 |
| Rock Island*** | 210,950 | 242,043 | 563,534 | 210,950 | 242,043 | 563,534 |
| Wanapum*** | 187,956 | 215,660 | 502,109 | 187,956 | 215,660 | 502,109 |
| Priest Rapids*** | 167,469 | 192,153 | 447,379 | 167,469 | 192,153 | 447,379 |
| McNary**** | 259,527 | 270,231 | 556,791 | 103,280 | 80,502 | 175,824 |
| John Day** **** | 380,867 | 189,162 | 494,754 | 176,291 | 81,959 | 216,506 |
| The Dalles** **** | 349,794 | 428,854 | 417,756 | 422,274 | 454,776 | 489,411 |
| Bonneville (I & II combined)** ***** | 426,122 | 424,565 | 413,578 | 183,762 | 166,175 | 178,831 |
| ---To the tailrace of Bonneville | 774,767 | 771,936 | 751,960 | 905,232 | 818,596 | 880,941 |
| ---To Tongue Point****** | 3,168,389 | 1,388,854 | 3,508,683 | 2,957,839 | 1,322,258 | 3,301,581 |
| **Percent listed fish at:** | | | | | | |
| *Snake River* | | | | | | |
| Lower Granite | 71.78% | 21.61% | 36.86% | 71.78% | 21.61% | 36.86% |
| Little Goose | 72.06% | 21.39% | 37.69% | 71.84% | 21.57% | 37.02% |
| Lower Monumental | 55.15% | 42.92% | 19.49% | 67.60% | 26.75% | 32.96% |
| Ice Harbor** | 67.37% | 31.22% | 30.31% | 68.67% | 25.87% | 33.82% |
| *Columbia River* | | | | | | |
| Wells*** | 58.11% | 41.89% | 100.00% | 58.11% | 41.89% | 100.00% |
| Rocky Reach*** | 65.48% | 34.52% | 100.00% | 65.48% | 34.52% | 100.00% |
| Rock Island*** | 46.57% | 53.43% | 100.00% | 46.57% | 53.43% | 100.00% |
| Wanapum*** | 46.10% | 52.90% | 99.00% | 46.10% | 52.90% | 99.00% |
| Priest Rapids*** | 45.64% | 52.37% | 98.01% | 45.64% | 52.37% | 98.01% |
| McNary**** | 44.08% | 45.89% | 61.48% | 51.14% | 39.86% | 52.33% |
| John Day** **** | 62.30% | 30.94% | 66.95% | 63.70% | 29.62% | 57.04% |
| The Dalles** **** | 43.44% | 53.26% | 72.68% | 46.39% | 49.96% | 62.51% |
| Bonneville (I & II combined)** ***** | 48.59% | 48.41% | 61.71% | 50.75% | 45.89% | 55.29% |
| ---To the tailrace of Bonneville | 48.59% | 48.41% | 61.71% | 50.75% | 45.89% | 55.29% |
| ---To Tongue Point**** | 61.71% | 27.05% | 34.90% | 61.13% | 27.33% | 34.82% |

* Note: "Total fish collected at:" is the total number of fish collected of that species, run and rearing type.

** Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.

*** Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established. Also, there is no transportation from these dams.

**** Note: (See next page)

**** Note: The percentage of listed wild and hatchery fish from each ESU at each Columbia River dam from McNary Dam to Bonneville Dam and at Tongue Point.

**For example** , If you handle 1,000 steelhead at Tongue Point, under the Full Transportation with spill scenario (above), 61.71% of them will be listed wild fish, or 617 fish. To these 617 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 617 x 0..5786 = 357; UCR, 617 x 0.0325 = 20; etc).

| | Full Transportation | | | Transportation with spill | | |
|---|---|---|---|---|---|---|
| | | Hatchery | | | Hatchery | |
| **McNary Dam** | **Wild** | **AD-clipped** | **No AD-clip** | **Wild** | **AD-clipped** | **No AD-clip** |
| SR | 13.69 | 4.27 | 6.09 | 46.74 | 25.56 | 22.59 |
| UCR | 52.27 | 79.57 | 75.39 | 32.25 | 61.87 | 62.15 |
| MCR - Summer | 34.04 | 16.16 | 18.52 | 21.01 | 12.57 | 15.26 |
| MCR - Winter | --- | --- | --- | --- | --- | --- |
| LCR - Summer | --- | --- | --- | --- | --- | --- |
| LCR - Winter | --- | --- | --- | --- | --- | --- |
| UWR - Summer | --- | --- | --- | --- | --- | --- |
| UWR - Winter | --- | --- | --- | --- | --- | --- |
| **John Day Dam** | | | | | | |
| SR | 6.89 | 3.36 | 6.09 | 29.05 | 21.13 | 22.59 |
| UCR | 26.31 | 62.68 | 75.39 | 20.05 | 51.16 | 62.15 |
| MCR - Summer | 66.80 | 33.96 | 18.52 | 50.90 | 27.71 | 15.26 |
| MCR - Winter | --- | 0.00 | 0.00 | --- | 0.00 | 0.00 |
| LCR - Summer | --- | --- | --- | --- | --- | --- |
| LCR - Winter | --- | --- | --- | --- | --- | --- |
| UWR - Summer | --- | --- | --- | --- | --- | --- |
| UWR - Winter | --- | --- | --- | --- | --- | --- |
| **The Dalles Dam** | | | | | | |
| SR | 4.90 | 2.56 | 1.73 | 22.17 | 16.83 | 7.33 |
| UCR | 18.69 | 47.72 | 21.38 | 15.30 | 40.73 | 20.16 |
| MCR - Summer | 76.41 | 49.72 | 76.89 | 62.53 | 42.44 | 72.51 |
| MCR - Winter | --- | 0.00 | 0.00 | --- | 0.00 | 0.00 |
| LCR - Summer | --- | --- | --- | --- | --- | --- |
| LCR - Winter | --- | --- | --- | --- | --- | --- |
| UWR - Summer | --- | --- | --- | --- | --- | --- |
| UWR - Winter | --- | --- | --- | --- | --- | --- |
| **Bonneville Dam** | | | | | | |
| SR | 3.93 | 2.40 | 1.73 | 18.44 | 15.92 | 7.33 |
| UCR | 14.99 | 44.75 | 21.38 | 12.73 | 38.55 | 20.16 |
| MCR - Summer | 61.28 | 46.62 | 76.89 | 52.01 | 40.16 | 72.51 |
| MCR - Winter | 14.36 | 0.00 | 0.00 | 12.19 | 0.00 | 0.00 |
| LCR - Summer | 3.41 | 0.00 | 0.00 | 2.90 | 0.00 | 0.00 |
| LCR - Winter | 2.03 | 6.23 | 0.00 | 1.73 | 5.37 | 0.00 |
| UWR - Summer | --- | --- | --- | --- | --- | --- |
| UWR - Winter | --- | --- | --- | --- | --- | --- |
| **Tongue Point** | | | | | | |
| SR | 57.86 | 53.62 | 45.31 | 55.49 | 51.68 | 42.52 |
| UCR | 3.25 | 9.90 | 11.74 | 3.43 | 10.57 | 12.34 |
| MCR - Summer | 13.28 | 10.32 | 42.24 | 14.03 | 11.02 | 44.39 |
| MCR - Winter | 3.11 | 0.00 | 0.00 | 3.29 | 0.00 | 0.00 |
| LCR - Summer | 1.86 | 1.12 | 0.00 | 1.97 | 0.00 | 0.00 |
| LCR - Winter | 13.54 | 23.92 | 0.71 | 14.30 | 25.54 | 0.75 |
| UWR - Summer | --- | 1.12 | 0.00 | --- | 1.19 | 0.00 |
| UWR - Winter | 7.10 | 0.00 | 0.00 | 7.49 | 0.00 | 0.00 |

SR = Snake River ESU
UCR = Upper Columbia River ESU
MCR - Summer = Mid Columbia River ESU summer steelhead
MCR - Winter = Mid Columbia River ESU winter steelhead
LCR - Summer = Lower Columbia River ESU summer steelhead
LCR - Winter = Lower Columbia River ESU winter steelhead
UWR - Summer = Upper Willamette River ESU summer steelhead
UWR - Winter = Upper Willamette River ESU winter steelhead

Table 11. Estimated number of listed fish outmigrating from each ESU, 2010.

| ESU | Run | Number of listed fish | | |
|---|---|---|---|---|
| | | | Hatchery[e] | |
| | | Wild | AD-clipped | Non-AD-clipped |
| Snake River | | | | |
| Chinook | Spring/summer | 1,558,109 | 5,238,900 | 926,636 |
| | Fall | | | |
| | - subyearlings | 417,580 | 3,410,000 | 3,756,330 |
| | - yearlings | | 256,000 | 688,000 |
| Steelhead | Summer | 1,975,083 | 2,483,500 | 828,868 |
| Sockeye | | 17,757 | 160,713 | 0 |
| Upper Columbia | | | | |
| Chinook | Spring | 701,101 | 346,000 | 1,127,000 |
| Steelhead | Summer | 222,416 | 635,000 | 255,000 |
| Mid-Columbia | | | | |
| Steelhead | Summer | 592,636 | 449,400 | 670,100 |
| | Winter | 105,218 | 0 | 0 |
| Lower Columbia | | | | |
| Chinook | Spring | 2,586,155 | 2,408,527 | 683,000 |
| | Fall (tule) | 9,615,345 | 31,881,264 | 452,653 |
| | Fall (late run) | 3,571,125 | 0 | 0 |
| Steelhead | Summer | 62,935 | 0 | 0 |
| | Winter | 457,521 | 866,500 | 10,000 |
| Coho | | 1,168,884 | 8,522,463 | 184,000 |
| Upper Willamette | | | | |
| Chinook | Spring | 3,847,700 | 5,990,750 | 50,000 |
| Steelhead | Summer | | 40,500 | 0 |
| | Winter | 239,830 | 0 | 0 |
| Columbia River | | | | |
| Chum | | 6,030,000 | 0 | 162,000 |

a Listed hatchery numbers are release numbers.

# Appendix A.

## Determination of the effects of returning all PIT-tagged spring/summer Chinook salmon to the river at each collection dam on the number of fish that arrive at each subsequent dam

We surveyed researchers regarding the number of outmigrating PIT-tagged spring/summer Chinook salmon in the Snake River we could expect in 2010. We found that 227,000 hatchery fish will be PIT tagged and released above Lower Granite Dam as part of the Comparative Survival Study (CSS). We applied the hatchery survival estimates found in Table 1 to the fish released from hatcheries to determine the number of CSS hatchery fish that will arrive at Lower Granite Dam (146,169). The CSS requires that 70% of the fish collected at each of the Snake River collector dams be transported.

Another 26,964 hatchery spring/summer Chinook salmon (PIT tagged at hatcheries (not part of the CSS) and traps) will arrive at Lower Granite Dam. Of the 173,133 (146,169 + 26,964) hatchery fish reaching Lower Granite Dam, 86,250 will be listed hatchery fish. It is unknown whether the PIT-tagged hatchery fish will be ad-clipped or not, so, because ad-clipped hatchery fish constitute the vast majority of hatchery fish, all PIT-tagged fish are assumed to be ad-clipped for the following calculations.

Because tagging for the 2010 outmigration year began in July 2009 and continues throughout the outmigration year, we cannot accurately estimate survival from tagging of natural and migrating fish to the head of the Lower Granite Reservoir. We assumed that all of these fish would survive to the head of the reservoir, realizing that this is an overestimation. We chose the head of the reservoir because that is where the last of the tagging occurs, and because we have survival estimates from the head of the reservoir to the tailrace of Lower Granite Dam. It is expected that 66,606 wild spring/summer Chinook salmon will be PIT tagged above Lower Granite Dam. Using 90% survival from tagging location through the Lower Granite Dam pool, 59,945 (66,606 x ) will arrive at Lower Granite Dam.

National Marine Fisheries Service will be PIT-tagging fish at Lower Granite Dam during the 2010 outmigration. As part of this marking, 30,000 PIT-tagged wild and 91,154 PIT-tagged hatchery spring/summer Chinook salmon will be released into the Lower Granite Dam tailrace. As these fish move downstream, all of those collected at Little Goose and Lower Monumental Dams will be diverted back to the river. Another 28,846 PIT-tagged hatchery spring/summer Chinook salmon will be released below Ice Harbor Dam.

Approximately 4,400 fish (400 wild and 4,000 hatchery) will be released in the Tucannon River. These fish are assumed to arrive at Lower Monumental Dam with no mortality.

We performed two calculations to determine the expected number of PIT-tagged fish collected at each collector dam. The first calculation made use of the same formulas used under the "Transportation with Spill" and "Full Transportation" scenarios which assume that every fish collected is transported (except the CSS fish). This calculation provided the number of fish collected at each dam if no PIT-tagged fish were returned to the river. In other words, this calculation is based solely on the number of fish that are not collected and transported at upstream dam(s).

In the second calculation we assumed that the only fish transported at each Snake River collector dam are the CSS fish. This calculation provided the number of fish collected at each dam if the remaining PIT-tagged fish were returned to the river. This calculation includes both the fish that were returned to the river at upstream dam(s) and the fish that were not collected at upstream dam(s). Because the number derived from the second calculation includes the number from the first calculation, the difference between the numbers from these two calculations is the number of PIT-tagged fish that were collected at each dam that were not accounted for because they were returned to the river at each dam (the number for each dam was added to the appropriate "... fish collected ..." columns in Tables 7-8). This difference in the number of fish collected was then expanded to the number of fish that arrived at the dam by dividing by the FGE of that dam, and was added to the number of fish that arrived at McNary Dam because they had not been collected and transported at upstream dams under both the "Transportation with Spill" and "Full Transportation" scenarios (column "Listed fish to McNary" in Tables 2 and 3, respectively).

**Calculation 1 (Transportation)**

**Transportation with Spill Scenario--**The numbers presented below assume that 60.9% of the PIT-tagged fish arriving at Lower Granite Dam will not be collected (FGE = 39.1%), and that 30% of the CSS fish are returned to the river. In addition, 30,000 wild and 91,154 hatchery fish will be released into the tailrace of Lower Granite Dam from marking at the dam, and 28,846 will be released into the tailrace of Ice Harbor Dam.

Using the FGEs in Table 2, the estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2010 will be

| Dam | Wild | Listed hatchery | Unlisted hatchery | Total |
|---|---|---|---|---|
| Little Goose | 27,115 | 31,990 | 48,160 | 107,265 |
| Lower Monumental | 9,408 | 12,211 | 16,487 | 38,106 |
| McNary | 6,248 | 10,894 | 17,950 | 35,092 |

**Full Transportation Scenario**--The numbers presented below assume that 40.0% of the PIT-tagged fish arriving at Lower Granite Dam will not be collected (FGE = 60.0%), and that 30% of the CSS fish are returned to the river. In addition, 30,000 wild and 91,154 hatchery fish will be released into the tailrace of Lower Granite Dam from marking at the dam, and 28,846 will be released into the tailrace of Ice Harbor Dam.

Using the FGEs in Table 3, the estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2010 will be

| Dam | Wild | Listed hatchery | Unlisted hatchery | Total |
|---|---|---|---|---|
| Little Goose | 31,577 | 35,357 | 58,481 | 125,415 |
| Lower Monumental | 7,851 | 10,567 | 14,170 | 32,588 |
| McNary | 5,088 | 12,758 | 24,041 | 41,887 |

**Calculation 2 (Only CSS fish transported)**

This calculation assumes that all collected PIT-tagged fish (except the CSS fish) are returned to the river at each Snake River collector dam.

For the PIT-tagged fish returned to the river at each collection dam, the only loss of fish as they migrate downstream is the mortality through each reservoir and dam. Based on the NMFS survival studies, survival through each reservoir and dam was estimated to be 90%. The estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2010 will be

**Transportation with Spill Scenario**

| Dam | Wild | Listed hatchery | Unlisted hatchery | Total |
|---|---|---|---|---|
| Little Goose | 36,670 | 38,414 | 53,025 | 128,109 |
| Lower Monumental | 23,076 | 21,442 | 28,453 | 72,971 |
| McNary | 22,371 | 21,796 | 32,407 | 76,574 |

**Full Transportation Scenario**

| Dam | Wild | Listed hatchery | Unlisted hatchery | Total |
|---|---|---|---|---|
| Little Goose | 52,618 | 49,500 | 69,193 | 171,311 |
| Lower Monumental | 36,628 | 29,252 | 39,297 | 105,177 |
| McNary | 47,470 | 40,008 | 61,111 | 148,589 |

Subtracting collection numbers estimated by Calculation 1 from Calculation 2 provides the number of unaccounted for PIT-tagged fish that were collected at each dam (Appendix Table A1).

Appendix Table A1. Estimates of the number of unaccounted for PIT-tagged spring/summer Chinook salmon that will be collected at each of the collection dams, and estimates of how many of these fish will arrive at McNary Dam, 2010.

**Transportation with Spill Scenario**

| Dam | Wild | Listed hatchery | Unlisted hatchery | Total |
|---|---|---|---|---|
| Number of unaccounted for PIT-tagged fish collected: | | | | |
| Little Goose | 9,555 | 6,424 | 4,865 | 20,844 |
| Lower Monumental | 13,668 | 9,231 | 11,966 | 34,865 |
| McNary | 16,123 | 10,902 | 14,457 | 41,482 |
| Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.377): | | | | |
| McNary | 42,767 | 28,918 | 38,347 | 110,032 |

**Full Transportation Scenario (No Spill)**

| Dam | Wild | Listed hatchery | Unlisted hatchery | Total |
|---|---|---|---|---|
| Number of unaccounted for PIT-tagged fish collected: | | | | |
| Little Goose | 21,041 | 14,143 | 10,712 | 45,896 |
| Lower Monumental | 28,777 | 18,685 | 25,127 | 72,589 |
| McNary | 42,382 | 27,250 | 37,070 | 106,702 |
| Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.800): | | | | |
| McNary | 52,978 | 34,063 | 46,338 | 133,379 |

# Appendix B.

## Determination of the effects of returning all PIT-tagged steelhead to the river at each collection dam on the number of fish that arrive at each subsequent dam

We surveyed researchers regarding the number of outmigrating PIT-tagged steelhead in the Snake River we could expect in 2010. We found that 27,400 (16,100 of which will be listed) hatchery fish will be PIT tagged prior to release above Lower Granite Dam. Based on the survival rates of the various hatcheries releasing fish, we estimate that 21,077 (12,269 of which will be listed) will arrive at Lower Granite Dam. Another 12,735 (5,517 of which will be listed) hatchery steelhead (PIT tagged at traps) will arrive at Lower Granite Dam, bringing the total to 33,812 hatchery fish (which includes 17,786 listed fish) arriving at Lower Granite Dam. In addition, 6,836 wild steelhead PIT tagged at traps will arrive at Lower Granite Dam.

National Marine Fisheries Service will be PIT-tagging steelhead at Lower Granite Dam during the 2010 outmigration. As part of this marking, 50,000 PIT-tagged fish will be released into the Lower Granite Dam tailrace. Of these, approximately 30,000 will be wild fish, 8,376 will be listed hatchery fish, and 11,624 will be unlisted hatchery fish. All of the fish collected at Little Goose and Lower Monumental Dams will be diverted back to the river. WDFW plans to release 1,550 PIT-tagged fish into the Tucannon River. Of these, 500 will be wild and 1,050 will be listed hatchery fish.

We performed two calculations to determine the expected number of PIT-tagged fish collected at each collector dam. The first calculation made use of the same formulas used under the "Transportation with Spill" and "Full Transportation" scenarios which assume that every fish collected is transported. This calculation provided the number of fish collected at each dam if no PIT-tagged fish were returned to the river. In other words, this calculation is based solely on the number of fish that are not collected and transported at upstream dam(s).

In the second calculation we assumed that no fish are transported. This calculation provided the number of fish collected at each dam if all PIT-tagged fish were returned to the river. This calculation includes both the fish that were returned to the river at upstream dam(s) and the fish that were not collected at upstream dam(s). Because the number derived from the second calculation includes the number from the first calculation, the difference between the numbers from these two calculations is the number of PIT-tagged fish that were collected at each dam that were not accounted for because they were returned to the river at each dam (the number for each dam was added to the appropriate "... fish collected ..." columns in Tables 9-10). This difference in the number of fish collected

was then expanded to the number of fish that arrived at the dam by dividing by the FGE of that dam, and was added to the number of fish that arrived at McNary Dam because they had not been collected and transported at upstream dams under both the “Transportation with Spill” and “Full Transportation” scenarios (column "Listed fish to McNary" in Tables 5 and 6, respectively).

**Calculation 1 (Transportation)**

**Transportation with Spill Scenario**--Assuming that 56.9% of the PIT-tagged fish arriving at Lower Granite Dam will not be collected (FGE = 43.1%), 3,889 (6,836 x 0.569) wild, 10,120 (17,786 x 0.569) listed hatchery, and 9,119 (16,026 x 0.569) unlisted hatchery fish will reach the Lower Granite Dam tailrace. In addition, 30,000 wild, 8,376 listed hatchery, and 11,624 unlisted hatchery fish will be released into the tailrace from marking at the dam. Therefore, the total numbers of PIT-tagged fish in the Lower Granite Dam tailrace will be 33,889 (3,889 + 30,000) wild, 18,496 (10,120 + 8,376) listed hatchery, and 20,743 (9,119 + 11,624) unlisted hatchery fish.

Using the FGEs in Table 5, the estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2010 will be

| Dam | Wild | Listed hatchery | Un-listed hatchery | Total |
|---|---|---|---|---|
| Little Goose | 16,684 | 9,106 | 10,212 | 36,002 |
| Lower Monumental | 5,536 | 3,354 | 3,258 | 12,148 |
| McNary | 1,324 | 957 | 779 | 3,060 |

**Full Transportation Scenario**--Assuming that 20.0% of the PIT-tagged fish arriving at Lower Granite Dam will not be collected (FGE = 80.0%), 1,367 (6,836 x 0.20) wild, 3,557 (17,786 x 0.20) listed hatchery, and 3,205 (16,026 x 0.20) unlisted hatchery fish will reach the Lower Granite Dam tailrace. In addition, 30,000 wild, 8,376 listed hatchery, and 11,624 unlisted hatchery fish will be released into the tailrace from marking at the dam. Therefore, the total numbers of PIT-tagged fish in the Lower Granite Dam tailrace will be 31,367 (1,367 + 30,000) wild, 11,933 (3,557 + 8,376) listed hatchery, and 14,829 (3,205 + 11,624) unlisted hatchery fish.

Using the FGEs in Table 6, the estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2010 will be

| Dam | Wild | Listed hatchery | Un-listed hatchery | Total |
|---|---|---|---|---|
| Little Goose | 25,408 | 9,666 | 12,011 | 47,085 |
| Lower Monumental | 1,977 | 1,311 | 781 | 4,069 |
| McNary | 777 | 1,144 | 307 | 2,228 |

**Calculation 2 (No Transportation)**

Assuming that 100% of the collected PIT-tagged fish are returned to the river at Lower Granite Dam, 36,836 (6,836 + 30,000) wild, 26,162 (17,786 + 8,376) listed hatchery, and 27,650 (16,026 + 11,624) unlisted hatchery fish will reach the tailrace.

Because 100% of the PIT-tagged fish were assumed to be returned to the river at each collection dam, the only loss of fish as they migrate downstream is the mortality through each reservoir and dam. Based on the NMFS survival studies, survival through each reservoir and dam was estimated to be 90%. The estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2010 will be

**Transportation with Spill Scenario**

| Dam | Wild | Listed hatchery | Un-listed hatchery | Total |
|---|---|---|---|---|
| Little Goose | 18,134 | 12,880 | 13,612 | 44,626 |
| Lower Monumental | 12,984 | 9,520 | 9,586 | 32,090 |
| McNary | 5,431 | 4,136 | 4,009 | 13,576 |

**Full Transportation Scenario**

| Dam | Wild | Listed hatchery | Un-listed hatchery | Total |
|---|---|---|---|---|
| Little Goose | 29,836 | 21,191 | 22,397 | 73,424 |
| Lower Monumental | 19,718 | 14,457 | 14,558 | 48,733 |
| McNary | 22,115 | 16,844 | 16,327 | 55,286 |

Subtracting collection numbers estimated by Calculation 1 from Calculation 2 provides the number of unaccounted for PIT-tagged fish that were collected at each dam (Appendix Table B1).

Appendix Table B1. Estimates of the number of unaccounted for PIT-tagged steelhead that will be collected at each of the collection dams, and estimates of how many of these fish will arrive at McNary Dam, 2010.

**Transportation with Spill Scenario**

| Dam | Wild | Listed hatchery | Unlisted hatchery | Total |
|---|---|---|---|---|
| Number of unaccounted for PIT-tagged fish collected: | | | | |
| Little Goose | 1,450 | 3,774 | 3,400 | 8,624 |
| Lower Monumental | 7,448 | 6,166 | 6,328 | 19,942 |
| McNary | 4,107 | 3,179 | 3,230 | 10,516 |
| Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.221): | | | | |
| McNary | 18,584 | 14,385 | 14,615 | 47,584 |

**Full Transportation Scenario (No Spill)**

| Dam | Wild | Listed hatchery | Unlisted hatchery | Total |
|---|---|---|---|---|
| Number of unaccounted for PIT-tagged fish collected: | | | | |
| Little Goose | 4,428 | 11,525 | 9,180 | 25,133 |
| Lower Monumental | 17,741 | 13,146 | 13,676 | 44,563 |
| McNary | 21,338 | 15,700 | 16,537 | 53,575 |
| Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.90): | | | | |
| McNary | 23,709 | 17,444 | 18,374 | 59,527 |